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THE UNIVERSITY OF ALBERTA

STROKE: PATTERNS OF INTER-INSTITUTIONAL UTILIZATION IN EDMONTON

by

© DOREEN M. MOORE

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF HEALTH SERVICES ADMINISTRATION

DIVISION OF HEALTH SERVICES ADMINISTRATION

DEPARTMENT OF COMMUNITY MEDICINE

EDMONTON, ALBERTA

SPRING, 1976

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled, "Stroke: Patterns of Inter-Institutional Utilization in Edmonton," submitted by Doreen M. Moore in partial fulfilment of the requirements for the degree of Master of Health Services Administration.

..... Supervisor

.....

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Date February 17, 1976

ABSTRACT

The research objective of this study was to identify and analyze patterns of in-patient inter-instituionalization of a selected population of patients with a diagnosis of first stroke. The purpose of this study was to collect selected base line data which could utlimately assist in health care planning, by examining inter-institutional utilization by a population of persons with first stroke.

The basic research design was that of a retrospective desceiptive two-part survey using data from various sources, primarily governmental and hospital. The data were analyzed in a descriptive manner. On a gross basis illustrative hospitalization and medical costs were estimated.

The study population consisted of 344 residents of Edmonton discharged from four general acute hospitals in Edmonton, between July 1, 1971 and June 30, 1972. The 259 survivors were followed for a period of one year following initial discharge in order to ascertain institutional utilization on a beginning longitudinal basis. An attempt was made to estimate hospitalization costs for all patients in the study; gross medical costs for the period of the study were examined for a sample of 37 patients. The population was examined in regard to a number of specific characteristics (e.g., age, sex, diagnostic category) regarded as potentially relevant to hospital utilization patterns.

The findings showed the characteristics of the study population generally to be in keeping with those described in the literature:

overall incidence, .78 per 1,000 population, increasing rapidly with age, for the initial insult; the patients' mean length of stay was 31.4 days with a range from one to 792 days; cerebral thrombosis was the most frequent categorical diagnosis; 25 per cent of the population died on first admission; the majority of surviving patients were discharged home; 8.8 per cent were discharged to long-term care institutions; and thirteen per cent were referred to an inpatient rehabilitation facility.

Within the twelve months following initial discharge, 124 patients were re-admitted to an institution at least once. The majority of re-admissions (63 per cent) were to acute general hospitals. At the end of the study period seventy per cent of the population were surviving; eleven per cent had been admitted to long-term care.

Approximately thirty per cent of patients with first stroke utilized one or more types of institutions two or more times, during the first year following discharge after an initial stroke; the majority of these admissions were to a general acute facility.

The central conclusion in regard to patterns of inter-institutionalization is that the acute general hospital played the major role in providing institutional care for the patients studied, for at least one year following initial stroke. Other patterns tended to be in accordance with those found in the literature.

The recommendations which were made were limited to factors regarding data collection. The investigator recommended consideration of cost estimation as demonstrated by Babson, and analysis of data as suggested by Gordon. The limitations of the study data did not allow

conclusions to be drawn, or recommendations made regarding specific planning of facilities.

ACKNOWLEDGEMENTS

I wish to extend my sincere thanks and gratitude to Dr. Shirley Stinson, for her encouragement, direction and assistance in the completion of this thesis. I also wish to acknowledge the example Dr. Stinson sets for those of us who are involved in all aspects of health care delivery by her understanding of the patients' needs, together with her recognition of the necessity to improve, by investigation, the methods of meeting those needs.

The assistance of Dr. C. Hazlett in design of the study and presentation of data is gratefully acknowledged. I also extend my thanks to Mr. B. Pickles for acting on my committee.

It would not have been possible for this thesis to have been completed without valuable assistance in data collection from the Alberta Health Care Insurance Commission, and the Alberta Hospital Services Commission. As well, I received willing assistance from the Medical Records Departments of the institutions involved in this study.

A National Health Fellowship from the Department of National Health and Welfare enabled me to attend the Masters' Program in Health Service Administration. This thesis is presented in partial fulfillment of the requirements of this course. I am extremely grateful for the educational opportunity afforded by this program.

Appreciation is also extended to Mrs. F. Burns for typing and proofreading the thesis. Her help was extremely valuable.

Finally, I would like to extend sincere thanks to all of those who assisted in the completion of this study.

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CHAPTER I

INTRODUCTION

The focus of this study is upon patterns of inter-institutional utilization of a defined population of patients suffering from their first cerebrovascular accident. By way of introduction, discussion of some aspects of chronic disease in general and cerebrovascular accidents in particular will first be presented, after which attention will be drawn to the specific purposes and objectives of the study.

Background to the Study: Chronic Disease

> The chronic diseases which strike older people today have not changed and are not likely to change dramatically in the coming years unless research leads to understanding of the etiology and pathogenesis of their illnesses which, in turn, will lead to modification of their course.[1]

The increase in both real numbers and the proportion of the population in North America suffering from chronic disease and disability is now well documented. It is usual to associate chronic disease with the older person, but McDonnell points out that half of the chronically disabled persons in North America are under fifty years of age. The over 65 age group produce a greater number (fifty per cent) proportionate to the ten per tent of the population they represent.[2]

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[1] J.E. McDonnell, "The Future of Long Term Care in B.C.," Proceedings of Seminar on Extended Care, B.C. Hospitals' Association, (Richmond , B.C.February 26 and 27, 1973): 70.

[2] Ibid.

It must also be recognized that there has been an increase in life expectancy, thereby an increase in the proportion of the population in the age group most highly associated with chronic disease. In Canada in 1931, the life expectancy for males was 60.0 years and for females 62.1 years; by 1971 these figures had increased to 69.4 years for males and 76.5 for females.[1]

Glazier has pointed out that the state of improved health in early and middle life results in a "legacy" of increased chronic disease and disability in late life.[2] In the United States, of every hundred males born in 1973, 8.3 are likely to die of chronic disease. Before death, however, many will suffer for varying periods from their disability; their level of dependence upon the health care system will vary according to the extent of that disability.

In Canada there is a need for further and more intensive survey information to supplement the "meager" information available in regard to chronic disease and disability.[3] It would appear that no recent assessment has been made by any organization at local, provincial or the federal level of the total number of Canadians disabled by chronic disease.[4]

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[1] Canada, Department of Health and Welfare, Hospital Morbidity and Total Mortality in Canada, Data for Priorities and Goals (Ottawa, January, 1974), table 3, p. 24.

[2] W.H. Glazier, "The Task of Medicine," Scientific American, 228 (April, 1973), 14.

[3] McDonnell, p. 69.

[4] Author's impression gathered from discussions originating at a Rehabilitation Seminar sponsored by the Canadian Rehabilitation Council for the Disabled and the Department of Health and Welfare, Canada, held in L'Estoril, Quebec, March 21-22, 1973.

Background to the Study: Cerebrovascular Accidents

In 1965 it was estimated that there were over 4.5 million disabled persons in Canada, and of that number 775,000 were affected with diseases of the heart and circulation including cerebrovascular disease (CVD).[1] "Cerebrovascular disease" is due to the impairment of circulation to and from the brain.[2] Although this diagnosis covers a wide range of clinical manifestations only those diseases manifested as cerebrovascular accidents, an acute episode of cerebral vascular disease with particular sequela colloquially termed "stroke," form the particular focus of this study.

As CVD is usually the precursor of non-traumatic stroke it is not possible to separate it completely from stroke because the disease remains after the completed stroke. Adams points out that the "word stroke emphasizes the rapidity of onset but not the cause of illness."[3,4] The investigator has chosen to use a functional definition which includes the criterion of episodic focal attacks giving rise to various neurological deficits. Transient ischemic attacks have been included in the study. These decisions were made by the investigator in light of her analysis of the literature and in recognition of the confusion resulting from the variability of definitions.

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[1] Canada, Department of Health and Welfare, Legislation, Organization and Administration of Rehabilitation Services for the Disabled in Canada, 1970 (Ottawa, 1971), table I-2, p. 36.

[2] World Health Organization, Cerebrovascular Diseases: Prevention, Treatment, and Rehabilitation, Technical Report, 469 (Geneva, 1971), p.54.

[3] Adams, G.F. Cerebrovascular Disability and the Aging Brain (Edinburgh and London: Churchill Livingston, 1974), p. 89.

[4] More extensive definitions of "stroke" are to be found in the Literature Overview, pp. 100-102.

Cerebrocascular disease is one of the most distinguishable groups of chronic disease. It is one of the most common and most disabling diseases of later life. In the United States it is one of the three leading causes of death[1] and in Canada beyond the age of 65, cerebro-vascular accidents and other manifestations of arterio-schlerosis are the overwhelming causes of death in both sexes.[2]

A high proportion of general hospital admissions are accounted for by CVD. In 1969 the diagnosis of CVD ranked ninth amongst 194 leading causes of admission in all hospitals participating in the Professional Activity Study; the only other chronic condition ranking higher was ischemic heart disease.[3]

A random sampling of patient days in Alberta's general hospitals in 1959 revealed that between ten and fifteen per cent of patient days were due to long term patients being treated for debilitating diseases such as stoke.[4] Separation for the general category of stroke from general acute hospitals in Alberta in 1971, 1972 and 1973 were as follows:

1971	1972	1973
3,889	4,027	3,705

The above figures represent approximately 1.2 per cent of all separations

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[1]Glazier, p. 14.

[2]Canada, Department of Health and Welfare, "Hospital Morbidity and Total Mortality in Canada," p. 10.

[3]"The Leading Causes of Admission PAS Hospitals, 1969," PAS Reporter, Vol. 9, No. 7, (May, 1971), table 1, p. 2.

[4]L. Protti, "Extended Care in Alberta," Proceedings of Seminar on Extended Care, B.C. Hospitals' Association, (Richmond, B.C., February 26 and 27, 1973): 47.

within the Province. These stroke patients accounted for almost seven per cent of all patient days within the Province.[1]

The latest national figures available are for 1969, and in that year patients with cerebrovascular disease accounted for 5.4 per cent of all hospital days utilized in Canada, over 2,900,000 days.[2] The predominant age group was 45 and over, and by age 65 cerebrovascular diseases accounted for 11.0 per cent of hospital days. The overall incidence of stroke has been estimated at five in every thousand hospital admissions, but in Toronto a study published in 1972 showed eleven in 560 admissions in a two-week period.[3]

In an attempt to assess the effect of stroke in a community, particularly in regard to the use of facilities, it was decided to concentrate on new stroke patients in this study. This particular population is not readily identifiable. Although recent figures from Alberta indicate that there are between 3,000 and 4,000 patients discharged annually from Alberta hospitals with a primary diagnosis of "stroke," patients suffering from their first stroke are estimated at approximately two-thirds of this figure.[4] These figures include those who died during their admission. The major problem faced by health care administrators in relation to stroke patients

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[1]Alberta Hospital Insurance Commission, "Statistics, 1971, 1972, 1973." Obtained from Research Department by investigator.

[2]Canada, Department of Health and Welfare, "Hospital Morbidity and Total Mortality in Canada," p. 10.

[3]R. Sky, "Managing and Rehabilitating the 'Stroke' Patient," Canadian Family Physician, Vol. 18, No. 12 (December, 1972): 64.

[4]Figures obtained from the Alberta Hospital Insurance Commission, corrected and projected by use of PAS records. The method by which these figures are obtained is explained in detail in chapter III.

centres around the provision of services for those persons who survive and then become dependent upon resources of the community. The number who survive the first stroke is estimated variously between 54 and 66 per cent by North American investigators.[1] There has been a tendency to assume that patients die within a few months of major stroke; however, recent studies have shown that patients who survived the acute insult continue to live for five years or more.[2] Of these, some proportion will require continuing care, either in an institutional setting or by the provision of alternate health care delivery, e.g., home care.

In a report published by the Joint Committee for Stroke Facilities (1969), it was estimated that for every hundred people who survive the acute illnesses, ten will be able to resume a full life with virtually no impairment, forty will have mild disability, forty will be so disabled as to require special services, and ten will need institutional care.[3]

A previous study indicated that in one rehabilitation hospital in Edmonton, patients with the diagnosis of stroke accounted for 6.7 per cent of all admissions in a one-year period, and these admissions accounted for fourteen per cent of the total days of stay in that institution.[4]

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[1] J.P. Whisnant, et al., "Natural History of Stroke in Rochester, Minnesota, 1945 through 1954," Stroke 2 (January-February, 1971): 11; also R. Carpenter, et al., "The Use of Medical Facilities for CVD. Patients in a County of Pennsylvania," Stroke 3 (November-December 1972): 50; and R.W. Boyle and M. Reid, "What Happens to the Stroke Victim?" Geriatrics 20 (1965): 949.

[2] F.J. Kottke, "Historia Observa Hemiplegia," Archives of Physical Medicine and Rehabilitation 55 (January 1974): 9.

[3] R. Stallones, et al., "Epidemiology for Stroke Facilities Planning," Stroke 3 (May-June 1972): 369.

[4] D. Moore, "Medical Rehabilitation: Some National and Local Aspects," (unpublished paper, Health Services Administration 1974): 33.

Although it was not intended that this should be an epidemiological study, in order to ascertain patterns of inter-institutionalization utilization it was necessary to examine certain selected characteristics of the population, and utilize certain demographic and epidemiological data for the purpose of analyzing pattern variability.

A province-wide longitudinal study would have been desirable. McKinley has pointed out the advantages of wider surveys, even national surveys, which allow the possibility of detecting regional variations.[1] Such a study was beyond the limitations of time for this investigator and a decision was made to localize the study to the Edmonton area.

The Purpose and Objectives of the Study

The purpose of the study was to collect selected base-line data about new stroke, which could be used in the planning of health care for the population of chronically ill and disabled.

The specific research objectives of the study were three-fold: (1) to describe a particular population of patients suffering their first stroke, in a defined community, in terms of specific characteristics, by following their course from discharge from the acute general hospital for one year; (2) to examine the patterns of in-patient inter-institutional utilization which developed over the study period; and (3) to estimate on a gross basis the institutional and medical costs

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[1] B. McKinley, "Some Approaches and Problems in the Study of the Use of Services - An Overview," Journal of Health and Social Behaviour 13:2 (June 1972): 117.

for those patients.

For the purposes of the study, the institutions referred to are three in type: (1) acute general hospitals; (2) a rehabilitation centre, an autonomous hospital providing both in-patient and out-patient rehabilitative services (it will be recalled that this study is concerned with in-patient services only); and (3) long-term care facilities including both auxiliary hospitals and nursing homes, which provide some elements of general hospital care on a less intensive level.

Inherent in the above foci is the examination of the extent to which data collection systems allow the compilation of accurate information necessary to achieve the objectives.

Kottke, referring to stroke in the United States in a recent article, deplores the paucity of information regarding patients after completed stroke. He states:

> The history of what happens to patients after they have suffered major strokes is obscured by a cloud of ignorance which is penetrated by only occasional rays of information giving us fragmentary vignettes regarding this condition.[1]

It is significant to note that in Canada in general, and Alberta in particular, the poverty of literature and recorded information extends even further. There is an absence of description of the incidence of stroke, the extent of utilization of acute general hospitals, rehabilitation, and/or auxiliary hospitals, and/or nursing homes, together with the cost of maintaining patients in these environments. Neither is the cost incurred in institutional care and medical services reported by the specific diagnosis. The following quote from

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[1] Kottke, p. 5.

Kottke would seem to apply equally well to the Canadian scene:

> There is essentially no organized information regarding the total cost of stroke which must include cost of acute health care, rehabilitation services and family and community cost of maintenance.[1]

As recently as 1973, the Joint Committee for Stroke Facilities identified a need for research in the area of stroke and 119 different topics were cited.[2] Kurtzke and Kurland suggest that there is a need for a "continued search for characteristics which might differentiate the stroke patient." One study of particular relevance would be the "collection of more definitive data as to stroke types, frequency and cause in different populations.[3]

The general literature indicates that patients suffering from the residual disability of stroke compose a significant group of those persons requiring extensive and continuing health services. The provinces take the major role in determining the policies governing the provision of health services for all their residents. In order to provide the best possible care and to identify possible alternative methods of care it is necessary to provide a data base on which policy might be determined.

Without adequate information, it is difficult for health

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[1] Ibid.

[2] R. Gifford, et al., "Training, Education, Manpower and Research for Stroke Care," Stroke 4 (May-June 1973): 515-519.

[3] J. Kurtzke and L.T. Kurland, "Epidemiology of Cerebrovascular Disease," in Cerebrovascular Survey Report for Joint Council Sub-Committee on Cerebrovascular Diseases, ed. by R.G. Siekert (Rochester: Whiting Printers and Stationers, 1970): 172.

administrators, policy makers and/or planners to make even gross predictions about the health services required by, and selected public costs for, the apparently sizeable group of people who represent an important part of the total chronic disease population - stroke patients.

Sequence of Presentation

The thesis is developed in terms of four components. Chapter II comprises a summary analysis of the literature; in chapter III the methodology is outlined; and in chapter IV the investigator presents and analyzes the data. The summary and conclusion then follow and recommendations are made.

CHAPTER II

SUMMARY ANALYSIS OF THE LITERATURE

The investigator attempted to search the literature relevant to this study and published primarily since 1962. The review was undertaken for the purpose of providing a general backdrop for the study and a basis for the methodology employed. A summary analysis is presented below. The reader may refer to Appendix B for a more detailed overview of the literature.

Prior to the 1960's most of the related literature concentrated on medical aspects alone. It was not until 1964 that the first organized review of stroke and epidemiologic research in cerebrovascular disease took place; also in 1970, the World Health Organization sponsored an International Conference, "Cerebrovascular disease, Prevention, Treatment and Rehabilitation," in Geneva. Since then there is growing evidence of considerable interest in all aspects of cerebrovascular disease and stroke.

The literature tends to have a definite geographical distribution, with the bulk originating from studies carried out in the United States of America. Other studies originate from Europe, with more scattered articles from elsewhere around the world. Very little literature has been produced in Canada on the aspects presently being considered in this study.

Unfortunately, the majority of studies have applied different types of measurement and different diagnostic criteria and, thus, it is difficult to compare results. Study populations have not always been derived from those patients suffering from their first stroke, as in this

present study, but frequently include all patients with a primary diagnosis of stroke.

Most authors suggest caution when assessing data obtained by use of retrospective studies because of the inaccuracies in recorded information. There has been heavy reliance upon hospital series, mortality statistics and population surveys. The formation of a Joint Committee for Stroke Facilities under the aegis of the American Neurological Association has encouraged the examination of available information together with research on aspects still inadequately considered.

Earlier literature emphasized various aspects of epidemiology, morbidity and mortality, including the various effects of related factors such as age, sex, geographical distribution, race, and environment. As the number of studies increased, all authors reviewed agreed that stroke is age related with incidence, prevalence and mortality all increasing with age. However, although some authors such as Stallones, Heyman and others show relationships between stroke and factors such as sex and race,[1] Kurtzke maintains that the relationships have not been fully evaluated and that they might be a function of other factors.[2]

Incidence rates are reported in most studies, but vary considerably. Prevalence rates, however, are not so frequently reported in the same studies as they are dependent upon population surveys.

Cerebrovascular death ranked among the three leading causes of

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[1]Appendix B, p. 105.

[2]Ibid.

death in forty countries of 57 reporting to the World Health Organization. In 1971, it was the third leading cause of death in Canada. Wylie suggests the probability of dying from stroke is 1:3.[1]

Fugl-Meyer, Eisenberg and others report high initial mortality rates.[2] The course of survival patterns seems to indicate that approximately twenty to 25 per cent will die from the initial insult but fifteen to forty per cent will survive five years, and twenty to thirty per cent eight years. Stallones et al. suggest that ten per cent of survivors will be completely independent, ten per cent will be completely dependent requiring institutional care and the remainder will require varying degrees of assistance.[3]

Much of the literature written by medical investigators is directed toward the disease process and identification of clinical categories, their manifestations and appropriate care. It is generally agreed that more patients suffer cerebral infarction than hemorrhage, but mortality rates at onset are higher for hemorrhage than any other category. These observations are dependent upon accurate diagnostic procedures and/or confirmatory autopsies. These criteria are not easily met. Many earlier studies excluded transient ischemic attacks from the general stroke categories, but recently the importance of recognizing transient ischemic attacks as indicators of pending stroke has been stressed.[4]

The examination of utilization of facilities by stroke patients

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[1] Ibid., p. 108.

[2] Ibid., p. 109.

[3] Ibid., p. 112

[4] Ibid., pp. 105-106.

is inadequately documented. Only a few authors have paid particular attention to this aspect. Utilization is thought to depend upon socio-economic and cultural considerations to some extent. Truscott reported that the majority of patients with stroke in the United States experienced their primary care in rural community hospitals of less than 200 beds[1] in contrast to Brewis who reported that most stroke patients were treated at home in Carlisle.[2]

Recent years have brought the development of sophisticated care models consisting of stroke clinics, stroke units, community stroke programs, home care, etc. One such model has been set up in Harlem. Richter and his team have found the intensive care stroke unit to function effectively and so have Drake and Dow. However, other authors question the value of such specialized units, believing effective care can be given to any patient in a more generalized intensive care unit.[3]

The "Stroke Centre" or specialized unit can have an advantage in providing specialized facilities for diagnosis and management, including rehabilitation. Dyken suggests that effective care in such a unit can decrease mortality of patients with cerebral infarction by as much as five and one half times. The stroke clinic of which Dow writes was terminated because of poor utilization. In contrast, Richter believes the stroke clinic to be most important and effective

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[1] Ibid., p. 113

[2] Ibid.

[3] Ibid., p. 114

in assisting patients, especially after discharge.[1]

Placement after discharge depends upon the patient's condition. Authors such as Shafer, Marquardsen, and others report that the majority of patients go home.[2] A small percentage, between seven and sixteen per cent, are referred to long-term care institutions.[3] Shafer, Matsumoto and others report comparatively few patients referred for intensive rehabilitation, but such rehabilitation could result in economic benefits.[4]

Alternative methods of provision of care are described in the literature, especially in relation to the problem of the rising cost of health care in institutions, which has precipitated the development of home care programs, stroke clinics, etc. Programs of community education directed at prevention and management have been advocated and developed. The effectiveness of such programs is reported by authors such as Bryant.[5]

Any literature reviewed in regard to costs provides estimates only. Authors such as Wylie, Carpenter and Kottke have endeavoured to establish estimates based on the prevailing per diem institutional rate.[6] In attempting to provide more accurate information regarding costs relative to disease categories, Babson has demonstrated a model which includes all costs, and is not based on a per diem rate.[7] The reduction of cost by the use of a home care program has been illustrated by Bryant.[8] Medical costs are not discussed in the literature.

The associated issue of data collection is not dealt with

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[1] Ibid., p. 114. [2] Ibid. [3] Ibid., p. 116.

[4] Ibid. [5] Ibid., p. 117. [6] Ibid.

[7] Ibid. [8] Ibid.

extensively. There is some interest in computerization of patient records, registries, etc. and Gordon, recognizing that much data are presently available from various sources, presents a model which might assist in the assembling, integration, summarizing and analysis of such material.[1] There would seem to have been very little written regarding the effect of stroke on the resources of the community, or the steps that can be taken for planning the facilities needed to assist the survivors of stroke.

The overall impression of the literature gained by this investigator is that the majority of investigations concerning stroke have been in relation to the clinical aspects, until recently, when more epidemiological studies have appeared. There has been little consistency in definition of stroke, some authors reporting on cerebrovascular disease rather than cerebrovascular accidents. Recently the importance of transient ischemic attacks has been recognized.

Investigators are aware of the lack of uniformity used to measure population indices, and although it has been observed that socio-economic and cultural aspects are probably important factors, there is very little information reported in this regard.

The literature tends to be geographically "clumped," and there is a paucity of Canadian studies in all aspects.

Administratively, few studies direct their attention to overall planning for this group of patients and the costs of delivering health care are virtually unknown - any reported costs are incomplete and must be regarded as estimates.

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[1] Ibid., p. 118.

CHAPTER III

METHODOLOGY

Introduction

It was decided that, given the investigator's time limitations, a study would be made of a defined population of patients suffering from their first CVA (stroke), and these patients would be followed for one year following their discharge from hospital. As far as was possible, the cost of hospitalization and medical care would be examined. It was hoped that this would give some indication of the extent of the problem of stroke in one community.

The methodology will be discussed in terms of research approach, study population and time frame; sources of data and procedures used; the initial survey; the follow-up survey; limitations of the study; and analysis of data.

Research Approach, Study Population and Time Frame

The study presented here is a descriptive survey, retrospective in nature, of a specified patient population derived from residents of Edmonton during a one-year period, July 1, 1971 to June 30, 1972. Those patients discharged with an established diagnosis of first stroke from one of the four acute general hospitals at any time during this period comprised the study population. This group was followed for a period of one year following discharge. Thus the total time span of the study is two years (see figure 1).

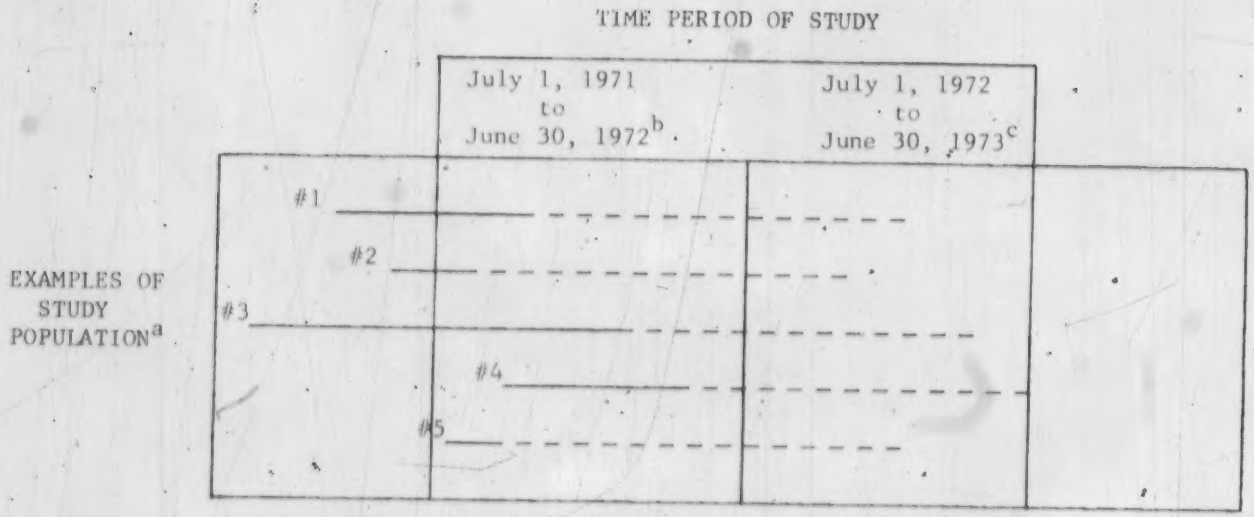

FIGURE 1. DIAGRAMMATIC REPRESENTATION OF TIME PERIODS USED IN STUDY

[a]Patients #1-5 demonstrate examples of original hospitalization dates (undotted line) and one-year periods of follow-up (dotted line), e.g.

Patient #1	Patient #5
Admitted December 1970	Admitted October 1971
Discharged December 1971	Discharged November 1971
Followed to December 1972	Followed to November 1972

[b]Time period July 1, 1971 - June 30, 1972 - period from which study population was derived.

[c]July 1, 1972 - June 30, 1973 - period during which patients from the study population were followed.

The above approach constitutes a beginning attempt at a longitudinal rather than simply a cross-sectional study, while at the same time permitting the use of recent data.

A preliminary survey was carried out in one general hospital to try to identify those patients discharged with a diagnosis of first stroke. Using a listing of discharges provided by the Alberta Health Services Commission (AHSC) the investigator found it possible to identify such patients.

It was decided that the study should be confined to residents of Edmonton (1) in order to facilitate accurate follow-up, and (2) on the principle that the first data needed in planning health care facilities for stroke patients in a given geographical area are data on the area's permanent residents. Discharge status was used rather than admission status to avoid as far as possible an incorrect admission diagnosis being used, as the admission diagnosis is regarded as provisional dependent upon confirmation by investigation.

Discharges from the four acute general hospitals chosen between July 1, 1971 and June 30, 1972 defined the population, as these hospitals shared the responsibility of responding to the acute care needs of the community. Another general hospital within the community was excluded as its primary purpose at that time was to serve non-residents of Edmonton. The hospitals used did not all share the same characteristics, however, and this was reflected later in the results.

Table 1 lists the variables used to describe the study population. The P.A.S. and A.H.C.I.C. numbers (Variables 1, 2) provided means of identification of the population, i.e., cases falling within the H-ICDA Codes 430-437, in terms of discharge diagnosis. Variables 3-5 pertain to

TABLE 1

VARIABLES USED TO DESCRIBE STUDY POPULATION

Variable Number	Variable
1	Hospital Identification number[i]
2	Alberta Health Care Insurance Commission number
3	Sex (a) male (b) female
4	Age (a) 0-44 years (b) 45-64 years (c) 65 and over
5	Marital status (a) married (b) single
6	Hospital[ii]
7	Month of discharge from hospital
8	Discharge status (a) alive (b) dead
9	Discharge diagnosis (H-ICDA code)[iii]
10	Discharge placement (a) auxiliary hospital (b) home (c) nursing home (d) rehabilitation hospital (e) other (f) not known (g) does not apply (patient deceased)
11	Length of stay, coded by number of days
12	Paralytic/non-paralytic

[i] In Alberta, the patient's hospital number is also the PAS identification number.

[ii] The four hospitals used were given a specific identifying code.

[iii] H-ICDA Codes 430-437. This coding enabled distinctions to be made between those persons discharged with and without residual paralysis. The addition of decimal point (.1) following the code number indicates a degree of residual paralysis.

social characteristics most frequently reported in the literature in relation to CVD studies. Although the investigator is aware of the potential relevance of socio-economic and cultural factors to the analysis of patterns of inter-institutional utilization, such data were not available. Variables 6-8 and 10-12 pertain to the identification of patterns of location, timing, discharge status, placement, duration of stay, and paralytic state. Of these, Variables 10 and 11 are of particular relevance to cost estimations.

The particular time frame of July 1, 1971 to June 30, 1973 was selected on the following bases:

(i) Accuracy of data from the Alberta Hospital Services Commission (AHSC) could only be guaranteed back as far as 1969 when the present methods of data storage were initiated. Therefore, any retrospective study would have to take this into consideration.

(ii) Information regarding medical costs had to be obtained from the Alberta Health Care Insurance Commission (AHCIC). The Medical Care Insurance Act was enacted in Alberta in 1969 necessitating the registration and coverage of all Alberta residents at that time. However, billing procedures for medical coverage of patients could not be considered accurate prior to January, 1970.[1]

(iii) The study could not extend beyond 1973 in order to insure availability of one year follow-up data for all patients discharged from hospitals or other health care institutions one year prior to that time, and a time lag of at least six months for data to be processed by AHSC and AHCIC had to be allowed. In fact data collection was not finished until July 1974.

It was, therefore, decided that the patient population would be

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[1] Personal communication with Dr. D. McLeod, Alberta Health Care Insurance Commission (July 1974).

derived from July 1, 1971 to June 30, 1972 and that the follow-up period for that population would extend for a further year, up to and including June 30, 1973.

Because of the lack of baseline descriptive data no specific hypotheses were developed in this study. Further, descriptive statistics were used for the most part because the quality of the data was unknown, and as they were gathered it became obvious that there would be severe limitations. It was therefore decided that there would be no use of inferential statistics.

Sources of Data and Procedures Used

There were two major foci of data collection: (1) descriptive data about patients exclusive of costs; and (2) descriptive data concerned with costs.

Sources and Procedures Used for Descriptive Data, Exclusive of Costs

There were three primary sources involved: AHSC; hospital records; and patient medical records.

Alberta Hospital Services Commission.

As the AHSC is the repository for statistical information in regard to hospital services, it was a rich source of information. Listings of patients discharged with a primary diagnosis of CVA from the four general hospitals in Edmonton within the stated time period were obtained. It was also possible to obtain information about those patients discharged to other institutions for which the AHSC had responsibility, thus facilitating the follow-up.

Hospital Records

All hospitals in Alberta are participants with the PAS[1] record system, and it was possible to use the information recorded to cross check patient information from AHSC, and establish the residency of the patients and exclude any patient who did not meet the criteria of having a primary discharge diagnosis of stroke.

Patient Medical Records

Patient medical records were a most important source of data, as evolving a definitive study population depended upon cross checking information obtained from AHSC and PAS sources with the actual patient chart, particularly establishing that the patient had suffered a first stroke. Other information derived directly from the chart included the diagnostic code, age, sex, marital status, discharge status, and discharge plans for each patient.

Procedures

The procedures used for data collection were as follows. Prior to the initiation of the study a letter was sent by the Director of the Alberta Hospital Services Commission to the Executive Directors and Medical Directors of all institutions in Edmonton which were eligible to be involved in the study.[2] Direct contact by the

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[1]PAS: Professional Activity Study. A computerized medical record information program operated by the Commission in Professional and Hospital Activities (CPHA). It is a United States based program to which 110 Alberta hospitals subscribe. PAS Reporter 11 (January 1973): 6.

[2]Letter from Dr. J.E. Bradley, M.D., Chairman, Alberta Hospital Services Commission, to Administrators, all active, auxiliary hospitals and nursing homes in Edmonton (June 22, 1973) (Appendix A).

investigator was made with the Executive Director of the four general hospitals in Edmonton and, through them, with their Medical Records Department in order to obtain accessibility to discharge lists, PAS records, and patient charts. Confidentiality of information was required of the investigator and this condition was strictly adhered to throughout the entire study.

The listings of discharges for the period under study obtained from AHSC were first cross checked with PAS records to determine which patients were residents of Edmonton, and to clarify if those patients had been discharged with a primary diagnosis of stroke according to hospital records. An interesting discrepancy became apparent at this stage. There appeared to be a consistent disparity between the number of patients recorded in the AHSC lists as primary stroke and the number in that category in the hospitals' PAS records.

Further investigation revealed that the discrepancy was due to a coding anomaly, resulting in an over reporting of as high as 33 per cent of primary stroke in the AHSC records. During the period under investigation, it was policy for AHSC to assign a code for primary CVA to all patients discharged from hospital with a history of stroke, irrespective of the actual cause of hospitalization. The practice was discontinued in 1973.[1]

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[1] Personal communication with Mr. W. Heard, AHSC Research Analyst (August 1973); also "... .in some provinces the diagnosis specifies the condition judged to be the main one for which the patient is hospitalized; in others it is the admission diagnosis," Canada, Department of Health and Welfare, "Hospital Morbidity and Total Mortality in Canada," p. 22.

Having obtained a corrected listing of patients diagnosed as primary stroke, in the four general participating hospitals, it was then necessary to examine each patient's medical record to ascertain that the stroke had been the patient's first. Any patient with a previous history of stroke was eliminated from the study. At the same time, information in regard to the previously described variables was obtained and recorded. A final study population of 344 patients was identified, these patients meeting the criteria of residency and first stroke occurring during the specified period.

Sources and Procedures Used for Data on Costs

Hospital Costs

In order to calculate hospitalization costs it was necessary to obtain data from AHSC. The average costs per patient day were obtained for each one of the four hospitals for each of the years 1971, 1972, and 1973. These costs were calculated for each hospital by taking the total sum of expenditures and deducting the revenue of ancillary operations, which gave the net expenditures; the figure was then divided by the total number of patient days to yield a net cost per patient day.[1] Hospitalization costs were computed for the total study population for the length of stay of the initial episode but not for the follow-up study as further hospitalization costs were computed for re-admissions for a sample only.

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[1] Cost information obtained directly from AHSC in consultation, July 1974. Further discussion of this point occurs in chapter IV.

Medical Costs

In order to obtain information relating to associated medical costs for the patients in the study, it was necessary to have access to the patients' profiles as maintained by the Alberta Health Care Insurance Commission (AHCIC). The need to retain confidentiality was of particular importance and it was decided that this could best be done by obtaining information from a sample of approximately ten per cent. The patients in the sample would be identified by AHCIC number only and information regarding the medical profile was compiled by staff of the AHCIC. The medical costs were computed for the total period for which the 37 patients in the sample were studied.

In calculating these costs it was recognized that it would be impossible to identify only those costs associated with the stroke episode and it's sequelae alone. Those costs which were considered obviously inappropriate were excluded.[1] The resultant costs must, therefore, be considered as the most accurate estimate of in-patient costs that could be obtained in the circumstances.

It was important that the sample chosen should be representative of the study population. As the sample was being chosen to assist in calculation of costs, it was considered that length of stay would be the critical variable. As the total length of stay would be to some degree dependent upon the number of re-admissions to a facility during

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[1] For example, any gynaecological, dental or chiropractic costs were excluded in the calculation. All other medical costs were included in the absence of any information which could have definitely excluded them from the study.

the study period, the sample was chosen by stratification. This is further explained later.

Initial Survey

As previously mentioned, the study consisted of two surveys. The first or initial survey involved the total study population of 344 patients. It will be recalled that the study population was defined as those persons who were residents of Edmonton, discharged from any one of the four acute general hospitals in Edmonton included in the study, with a primary diagnosis of first stroke during the period of July 1, 1971 to June 30, 1972.

The descriptive information was obtained and coded and analyzed for the first admission. The in-patient hospitalization costs for the individuals in the initial survey were computed manually on the basis of length of stay and net cost per patient day.

Follow-up Survey

It will be recalled that the follow-up period was one year following discharge, ending June 30, 1973. The second part of the study, therefore, involved the 124 patients who were re-admitted as in-patients one or more times to an institution within one year following their discharge from an acute general hospital to which they had been admitted with a first stroke. This group represented 48 per cent of those discharged alive following their stroke.

Information obtained from the same sources as used previously was coded in the following manner for each re-admission, and subse-

quently analyzed.

1. Number of re-admissions to an institution in the year following discharge.

2. Primary diagnosis/diagnoses: a) CVA, b) non-CVA.

3. Hospital(s) of re-admission:

   a) any of the original four
   b) other acute hospital
   c) rehabilitation hospital
   d) extended care facility.

4. Length(s) of stay (by period of time rather than days).

5. Discharge status: a) alive, b) dead.

Because it was not possible to obtain and compute the hospitalization and medical costs for all persons who had subsequent re-admissions to an institution, nor was it possible to obtain patient profiles on all patients in the initial survey to ascertain medical costs, it was decided to pursue a rough estimate of these costs through the use of a sample of the study population for which the data could be obtained, as previously discussed.

The sample was a stratified random sample of approximately ten per cent of the study population (n = 37). It was stratified by admissions and included a sample of those who died on the first admission. The resulting sample distribution was as follows:

1. patients who died on the first admission (n = 9)

2. patients discharged alive and not re-admitted within the study period (n = 17)

3. patients who had one subsequent re-admission within the study period (n = 8)

4. patients with two re-admissions within the study period (n = 3)

5. patients with three or more re-admissions within the study period (n = 2).

Statistical tests were done to determine the representativeness of the sample. This was considered to be important, especially in regard to length of stay, the variable being used to provide the cost estimate. If the sample costs were going to be used as indicative of costs for the study population as a whole, the representativeness of the sample was extremely important. The sample was tested by use of "t" tests and was found to be representative for cost estimate purposes as there was no significant difference between the length of stay of those patients in the sample and the length of stay of those in the study population. The hospitalization and medical costs were then computed, as indicated previously.

Limitations of the Data

The investigator recognizes several limitations of the data which might affect the validity and reliability of the study. Some were recognized before data collection began, others became apparent only as the study proceeded.

Those Apparent Before Data Collection Began

Length of Study.

The time frame was limited because of the constraints regarding the availability of reliable data and the amount of time available to the investigator.[1] Regardless of the latter consideration it was not

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[1] Previously discussed on page 21.

possible to do an extensive retroactive study as data were not available in a consistent form prior to 1970.

Differences Between the Hospitals in the Study.

The scope of practice of the four hospitals varies considerably even though each can be considered an acute general hospital. The amount of research and educational activities varied as well as admitting practices. Whilst all four hospitals had some rehabilitation therapy available (e.g., physical therapy, occupational therapy), only one had a department of rehabilitation medicine, and it could be posited that this would have some effect on factors such as length of stay. Some of these differences became obvious in the analysis of data.

Variability of Costs: Extenuating Circumstances.

It was recognized that hospitalization costs as calculated in this study would not reflect the varying severity of the disease in individual patients and, therefore, the variable costs of resources which may have been used, e.g., intensive care. A long term stay in the acute hospital cannot necessarily be assumed to indicate continuing severe cerebrovascular disease necessitating acute care; often other medical and social care considerations are involved and frequently length of stay, hence hospitalization costs are dependent upon these factors.

It must be underlined that the net per diem cost is not an accurate technique of reliably computing cost of care. However, to this date information is not readily available in regard to cost of

care for specific diagnoses, and it was considered important to estimate the cost to the community of hospitalization for this chronic problem.[1]

Limitations which Became Apparent During Data Collection and Analysis

Inflated Incidence.

The problem of inflated provincial and, therefore, national figures on CVA has been discussed. The method of coding was changed in January of 1973 to reflect the patient's primary diagnosis instead of a diagnosis such as CVA which would take precedence over another diagnosis which, in fact, might have been the precipitating reason for hospital admission. It was possible to correct the potential problem by cross checking PAS records and individual files.

Inconsistencies in AHCIC Numbers.

In Alberta during the period of the study, the identification of a patient involved the assignment of a unique number to each registered resident. In a family unit the various members were identified by the last three digits of an eleven digit number. During the study it was found on occasion that an incorrect AHCIC number had been used and/or recorded at time of admission. In those cases, billing to the Health Care Insurance Commission and to the Health Services Commission would, therefore, be incorrectly submitted. Subsequent recall of information by AHCIC number to ascertain the

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[1] In his book, Disease Costing, John Babson illustrates a method whereby select diagnostic costs might be more accurately estimated (Manchester: University Press, 1973).

number of re-admissions, therefore, also had a built in error factor only discoverable by checking the patients' hospital records. In the sample of 37 patients two were found to be incorrectly classified as re-admissions on this account, an error rate of 5.4 per cent. Given the limitation of the data gathering procedures in this study, there is no valid basis on which to estimate the degree to which error rate might apply to the total Alberta population. As for the total study population, the error was not computed, as apart from the sample population patients were not followed through AHCIC, in keeping with the constraints of the investigator's agreement with AHCIC.

The Assignment of H-ICDA Codes.

The H-ICDA code which is assigned by medical records is dependent upon there being reliable and sufficient information in the discharge summary in the patient's file. For example, if the information is deficient, it is possible for the medical librarian to miss the fact that the patient was suffering from residual paralysis at the time of discharge. The charts used in the study were checked to try and eliminate this source of error. However, it is possible that in the general population the proportion of patients with residual paralysis is under-reported. It is unlikely the error would occur in the opposite direction.

Assignment of Differential Diagnosis.

The descriptive statistics in this study concerning diagnoses are dependent upon the differential diagnosis made by physicians. Of the 344 patients studied, over fifty per cent were coded in a general

non-specific category. Because time did not allow an intensive search of the patient records for each re-admission, it was not possible to estimate how many diagnoses may have been charged following the initial episode. The investigator is aware of one such incident.

Reliability of "Discharge Planning."

The patient's file and/or discharge summary usually indicated the discharge plans for placement following discharge. However, when computed these data did not always match those derived from information on subsequent re-admissions. For example, plans to have a patient re-admitted into a rehabilitation centre may not have materialized.

Limitation of One Year Follow-up Data.

Of the 259 patients discharged alive following their initial stroke, only 124 (47.8 per cent) were re-admitted to institutions reporting to AHSC during the twelve-month follow-up. It has not been possible to follow the remaining 135 patients, but it is recognized that some may have died or have been admitted to private nursing homes during that period. The population, therefore, studied in the follow-up was restricted to those who were re-admitted to those institutions reporting to AHSC within one year following discharge from the acute hospital. An interview process could have provided more, and possibly more accurate, information; however, such a procedure would have contravened the policy of confidentiality to which the investigator was bound.

Medical Costs.

The medical costs must be regarded only as very rough estimates. Inconsistencies were discovered on the examination of the profile of the sample group, e.g., for two persons there were no records of any medical costs even though the patients had valid AHCIC numbers and had received medical care, and there was no evidence of a profile on these patients. Two cases of incorrect identification numbers have already been cited. Therefore, in the sample of 37, there were at least four sources of error. It was not always possible to judge from information available which medical costs had been incurred because of stroke alone. Errors were found in the actual billing, relating to incorrect charges for specific medical procedures and charges made on behalf of another party because of incorrect AHCIC numbers.

Analysis of Data

It became clear during collection of data that there were many potential sources of unreliability. It was, therefore, considered most appropriate to compile a simple descriptive analysis of the data. Statistics calculated included mean mode, median, and range. Analyses were done on each of the four hospitals in the initial survey, for each age group, for those discharged alive, and for those with and without residual paralysis following the initial episode. A "t" test was used to determine any statistical differences between the average length of stay in the various hospitals.

The sample was analyzed in order to calculate the descriptive statistics necessary to examine it. It was considered appropriate to

do a "t" test between the sample and the study population to find if it was representative, and this was a critical variable. It was known to be representative of the population in regard to total admissions because of the manner of stratification.

The presentation and the analysis of the findings are presented in the following chapter.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

The presentation and analysis of data is divided into three major sections. The first contains primarily descriptive data on patients in relation to their original admissions. This section is further subdivided to deal with specific findings regarding the study population and the sample population. Hospitalization costs for both the study and the sample populations for the initial admission for stroke are also cited.

The second section relates to subsequent re-admissions during the twelve-month period following initial discharge of patients, taking into consideration the total study group and the sample. Hospitalization and medical costs are discussed in relation to the sample group only.

In the third section a discussion of findings of this study in relation to the literature is presented. Considerations regarding the reliability and validity of the data are discussed throughout.

First Admission

The Study Population

The study population consisted of 344 patients drawn from four acute general hospitals in Edmonton, between July 1, 1971 and June 30, 1972 having a discharge diagnosis of first CVA (stroke). It should

again be emphasized that the 344 patients represent only a portion of all the patients discharged from these hospitals with a primary diagnosis of CVA during the same period. For example, during the first six months of the study period, July 1 to December 31, 1971, AHSC reported 364 separations of patients with stroke from the four hospitals involved. Of these, 161 (44.2 per cent) met the study criteria. The remainder consisted of patients who were not residents of Edmonton and/or those who had records of pre-existing episodes of CVA. In fact, the study population represented approximately ten per cent of all separations for stroke in the province during the study period.

The patients were unequally divided among the four hospitals (table 2). Hospital Three accounted for the largest number, 40.4 per cent. In regard to sex and marital status the patients were almost evenly divided amongst the four hospitals. Age group variations were obvious, but in each hospital the greatest number of patients were in the 65 years and over age group. This particular group of 230 patients accounted for seventy per cent of the total study population. Detailed description of the selected variables follows.

Length of Stay

For all four hospitals, the length of stay covered a range from one to 792 days. The mean length of stay for the total study population was 31.4 days, for those who survived 30.9 days, and for those who died on their first admission 32.9 days. Sixty-six per cent of the study population stayed twenty days or less but 6.1 per cent stayed

TABLE 2

TOTAL STUDY POPULATION BY HOSPITAL, SEX, AGE GROUP

DISCHARGE STATUS, AND STATE OF PARALYSIS

Acute General Hospitals[a]	N	SEX		AGE GROUP			DISCHARGE STATUS		RESIDUAL PARALYSIS/ NO PARALYSIS	
		M	F	0-44	45-64	65+	Alive	Dead	RP	NP
1 (20.0)	80	46	34	4	17	59	68	12	23	57
2 (49.5)	56	23	33	0	20	36	44	12	10	46
3 (34.4)	139	76	63	4	42	93	94	45	71	68
4 (23.9)	69	42	27	11	16	42	53	16	34	35
Totals	344	187	157	19	95	230	259	85	138	206
TOTAL (31.4)	344	344		344			344		344	

[a]Average length of stay is indicated by figures in brackets

over one hundred days.

If one compares the average length of stay of the subjects in this study with that of all Alberta patients with a primary diagnosis of stroke, within the same period, there is considerable difference.[1] Table 3 shows this difference, together with the average length of stay for all patients in the participating hospitals and in all Alberta hospitals.

There was considerable variation in the mean length of stay between the four hospitals, ranging from twenty days to 49.5 days (table 3). The difference was tested for significance using a "t" test at $\alpha = .05$. There was a significant difference in the length of stay between Hospital Two as compared to Hospitals One and Four.

If the study population is considered in terms of patients with or without residual paralysis, the length of stay figures differ considerably. Table 4, subtable (i) indicates the average length of stay for those with paralysis as 44.1 days, as compared to 24.9 days for those without. As each of the four hospitals provide rehabilitation services to some extent, the longer utilization by those with residual paralysis might be explained by the need for continued therapies.

In table 4, subtable (ii), the length of stay is broken down by age group. The average length of stay increases with age, most notice-

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[1] The reader is reminded again of the essential difference in definition between the patient with a primary diagnosis of first stroke, as in this study, and the more expansive definition of primary diagnosis as recorded by AHSC at that time.

TABLE 3

AVERAGE LENGTH OF STAY FOR ALL PATIENTS WITH "STROKE" COMPARED TO AVERAGE LENGTH OF STAY OF ALL DISCHARGED PATIENTS, AND AVERAGE LENGTH OF STAY OF STUDY POPULATION IN SURVEY HOSPITALS AND ALL ALBERTA, BY YEAR, 1971-1973[a]

HOSPITAL	YEAR	Average L.of S.[c] stroke patients	Average L.of S. all patients	Average L.of S. Study Population
1	1971	22.12	9.1	20.0
	1972	18.09	9.1	
	1973[b]	20.17	8.9	
2	1971	41.19	9.3	49.5
	1972	33.64	9.2	
	1973[b]	33.80	8.9	
3	1971	25.9	7.9	34.4
	1972	34.6	8.0	
	1973[b]	23.79	7.7	
4	1971	25.8	12.1	23.9
	1972	27.94	12.7	
	1973[b]	25.8	12.2	
All Alberta Hospitals	1971	47.52	8.6	31.4
	1972	50.42	8.6	
	1973[b]	72.08	11.2	

[a]Derived from statistics supplied directly to the investigator by the Alberta Hospital Insurance Commission, July, 1974.

[b]Figures for 1973 are approximate.

[c]Length of Stay.

TABLE 4

LENGTH OF STAY FOR FIRST ADMISSION, IN DAYS, BY PARALYTIC STATE, AGE, AND SEX: STUDY POPULATION

(i) Length of Stay by Paralytic State

PARALYTIC STATE	N	Mean	Minimum	Maximum	Range	Median	Mode
Residual Paralysis	138	44.1	1	521	520	19	1
No resid. Paralysis	206	24.9	1	792	791	10	1 5*
Total	344	31.41	1.0	792	791	13.5	1.0

*Bimodel distribution

(ii) Length of Stay by Age

AGE GROUPS	N	Mean	Minimum	Maximum	Range	Median	Mode
0-44	19	10.78	1.0	29.0	28	10.87	1.0
45-64	95	18.45	1.0	191.0	190	12	1.0
65+	230	38.47	1.0	792.0	791	15.0	5.0
Total	344	31.41	1.0	792	791	13.5	1.0

(iii) Length of Stay by Sex

SEX	N	Mean	Minimum	Maximum	Range	Median	Mode
Male	187	28.42	1.0	792	791	13.41	1.0
Female	157	34.98	1.0	521	520	15	1.0
Total	344	31.41	1.0	792	791	13.5	1.0

able in the 65 and over age group, the average being 38.4 days with 75 per cent staying less than 28 days. In this older age group 8.3 per cent stayed over one hundred days.

Further examination of the data showed that of those discharged to an auxiliary hospital, none had stayed less than fifty days in the acute hospital, the range being from fifty to 792 days and the average being 222 days. Of those discharged to a nursing home, the length of stay in the acute hospital had ranged from twelve to 231 days, with an average stay of 106.2 days.

When broken down by sex, females tended to stay longer than males (table 4, subtable (iii)).

Age

Three main age groups were considered for the purpose of this study; 0-44 years of age, 45-64, and 65 and over. Some aspects of the effect of age have been mentioned already. The dramatic increase in incidence with increasing age has been documented, only 5.5 per cent being under the age of 44.

Of the younger group, a high proportion (six) died on first admission (31.5 per cent). No one stayed in hospital longer than 29 days (average was 10.7 days). There was an equal division between those with and those without paralysis, but more females were in the group than males.

In the 45-64 age group, there were more males (57.8 per cent); eighteen died (18.9 per cent), 24.2 per cent suffered a cerebral thrombosis. In this age group, 75 per cent stayed less than 21 days,

the average being 18.4 days, and 36.8 per cent suffered paralysis.

The seventy per cent of the study population accounted for in the 65 years and over age group had slightly more males in the group. Of the total 230, 36.5 per cent died, and the greatest percentage (thirty per cent) were diagnosed as "acute but ill defined CVD."

Sex

The differences related to sex have been mentioned to some extent. For both male and female the most common diagnosis was "acute but ill defined CVD." For females the average length of stay was 34.9 days with 75 per cent staying less than 27 days; for males the average was 28.4 days, 75 per cent staying less than 24 days. Paralysis affected males and females almost equally.

Discharge Status

Of the study population, 259 patients were discharged alive (75.3 per cent), 165 without any residual paralysis. The 85 patients who died were equally divided between male and female. The 42 females who died represented 26 per cent of the female population, and the 43 males, 22.9 per cent of the male population.

The most frequently occurring diagnosis of those who died was "acute but ill defined CVD" (40.5 per cent) compared to a more generalized diagnostic pattern for those who survived. The most common diagnosis for those who survived was cerebral thrombosis (24.3 per cent) and again "acute but ill defined CVD" (24.7 per cent).

Although the average length of stay of those who died was 32.9 days, 27.1 per cent died within 24 hours. Fifty one per cent of these

who died had paralysis - this could be an underestimate if the patient did not regain consciousness before death.

Discharge Placement and Paralytic Status

As it can be expected that the patient's paralytic status, i.e., whether he has a residual paralysis or not, might have some influence on discharge plans and placement, table 5 illustrates the discharge placement in relation to the presence or lack of paralysis. Although the largest percentage in each group was discharged home, there is a considerable difference between the two percentages. Of those with residual paralysis 32 patients (34 per cent) were coded as being discharged for further intensive rehabilitation at a specialized rehabilitation facility. On further investigation it was found that only 29 of the 32 patients were, in fact, admitted to that facility as in-patients.

It was not possible for the investigator to ascertain the number of patients who received continuing rehabilitation services as out-patients, as this was beyond the parameters of the study. Referral as an in-patient to a designated rehabilitation centre is usually indicative of a severe physical problem necessitating intensive treatment.

A relatively small percentage of patients was referred directly either to an auxiliary hospital (4.6 per cent) or to a nursing home (4.2 per cent). The length of stay of those referred has been noted. The six patients with paralysis discharged to an auxiliary hospital accounted for 1,256 acute hospital days, 21.6 per cent of the total

TABLE 5

DISCHARGE PLACEMENT FOR PATIENTS DISCHARGED ALIVE FROM FIRST ACUTE GENERAL HOSPITAL ADMISSION, WITH AND WITHOUT RESIDUAL PARALYSIS: STUDY POPULATION

PARALYTIC STATE	N	Rehabilitation Hospital	Auxiliary Hospital	Nursing Home	Home	Other[a]	Not Known[b]
Patients with Paralysis	94(36.2%)	32(34.0%)	6(6.4%)	3(3.2%)	42(44.7%)	10(10.6%)	1(1.1%)
Patients without Paralysis	165(63.8%)	2(1.3%)	6(3.6%)	8(4.8%)	139(84.2%)	9(5.5%)	1(0.6%)
Total	259(100%)	34(13.1%)	12(4.6%)	11(4.3%)	181(69.9%)	19(7.4%)	2(0.7%)

[a] Other - This term includes patients returning to relatives or going outside the province.

[b] Not Known - The discharge plans for these patients were not recorded on the hospital chart.

patient days spent by those with paralysis in the acute hospitals. The six patients without paralysis discharged to an auxiliary hospital accounted for 1,409 acute hospital days, 28.37 per cent of the total patient days spent by those without paralysis. In total, twelve patients (3.4 per cent) of the study population accounted for 24.67 per cent of the total patient days spent in the acute hospitals and 33.3 per cent of the days spent by those who survived the initial insult.

Further analysis of those discharged with or without residual paralysis is shown in tables 6 and 7. The incidence of paralysis in males and females was almost equal (40.6 per cent and 39.5 per cent respectively) and although there was an increase in the actual percentage of persons with paralysis as age increased, e.g., 68.1 per cent of those with paralysis were 65 and over, the highest percentage affected was in the 0-44 years age group; 47.4 per cent of that group had paralysis (see table 5, subtable ii).

Diagnostic Code

Table 7 shows the total study population in terms of diagnostic codes (H-ICDA) and hospital of admission. It is possible to differentiate those with and without residual paralysis. A code number followed by decimal point one indicates a degree of residual paralysis. This study does not identify the severity of the disability.

Table 8 shows each diagnostic category as a percentage of the total study population. Codes 430 through 435 are considered to be the most definitive, therefore in this study 148 patients (43 per cent)

TABLE 6

PARALYTIC STATE BY SEX, BY AGE, AND BY DISCHARGE STATUS[a]

PARALYTIC STATE[b]	SEX			AGE				DISCHARGE STATUS		
	Male	Female	Line TOTAL	0-44	45-64	65+	Line TOTAL	Alive	Dead	Line TOTAL
WITH	(76)	(62)	(138)	(9)	(35)	(94)	(138)	(94)	(44)	(138)
	55.1	44.9		6.5	35.4	68.1		68.1	31.9	
	40.6	39.5	40.1	47.4	36.8	40.9	40.1	36.3	51.8	40.1
	22.1	18.0		2.6	10.3	27.3		27.3	12.8	
WITHOUT	(111)	(95)	(206)	(10)	(60)	(136)	(206)	(165)	(41)	(206)
	53.9	46.1		4.9	29.1	66.0		80.1	19.9	
	59.4	60.5	59.9	52.6	63.2	59.1	59.9	63.7	48.2	59.9
	32.3	27.6		2.9	17.4	39.5		48.0	11.9	
TOTAL	(187)	(157)	(344)	(19)	(95)	(230)	(344)	(259)	(85)	(344)
	54.4	45.6	100	5.5	27.7	66.8	100	75.3	24.7	100

[a] Numbers are enclosed in parenthesis and percentages in subtables refer to row, column, and total percentages. For example, in SEX: 55.1% of those with paralysis were male
40.6% of males were paralytic
22.1% of total study group were males with residual paralysis.

[b] Patients discharged with and without residual paralysis following first admission for stroke.

TABLE 7

P-ICDA DIAGNOSTIC CODES 430, 430.1 . . . 437.1[a] BY ACUTE GENERAL HOSPITAL: STUDY POPULATION

Acute General Hospital		430	430.1	431	431.1	432	432.1	433	433.1	434	434.1	435	436	436.1	437	437.1	TOTALS
1	N	2	1	2	0	7	3	10	9	1	0	8	11	10	15	1	80
2	N	2	1	3	0	4	1	9	4	0	0	5	6	3	17	1	56
3	N	5	5	5	7	6	3	3	29	0	2	13	15	22	34	0	139
4	N	0	1	3	5	9	3	7	12	1	2	3	6	12	5	0	69
TOTAL FOR STUDY		9	8	13	12	26	10	29	54	2	4	29	38	47	61	2	344
HOSPITALS		17		25		36		83		6		29	85		63		344

[a]For definition of codes, see Appendix C (decimal point following code numbers signifies a degree of residual paralysis).

TABLE 8

DIAGNOSTIC CATEGORY BY PARALYTIC STATE AT INITIAL DISCHARGE: STUDY POPULATION

H-ICDA Code	Diagnosis	Total N(%)	N without residual paralysis	(%)	N with residual paralysis	(%)
430	Subarachnoid Hemorrhage	17 (4.9)	9	(4.3)	8	(5.8)
431	Cerebral Hemorrhage	25 (7.3)	13	(6.3)	12	(8.7)
432	Occlusion of precerebral arteries	36 (10.4)	26	(12.6)	10	(7.2)
433	Cerebral Thrombosis	83 (24.1)	29	(14.0)	54	(39.1)
434	Cerebral Embolism	6 (1.7)	2	(.9)	4	(2.9)
435	Transient Ischemic Attacks	29 (8.4)	29	(14.0)	-	-
436	Acute but ill defined CVD	85 (24.7)	38	(18.4)	47	(34.1)
437	Generalized Ischemic CVD	63 (18.3)	61	(29.6)	2	(1.4)
ALL CODES		344	206		138	

had discharge diagnoses which were generalized and ill defined. The single greatest percentage of the ill defined diagnostic group (41.2 per cent) was discharged from Hospital Three. The majority of persons with residual paralysis were from code 433.1 and 436.1 (73.2 per cent).

Of those patients having a diagnosis of cerebral hemorrhage (code 431 and 431.1), 64 per cent died as a result of the first insult. Subarachnoid hemorrhage (code 430 and 430.1) resulted in a mortality rate of 53 per cent for the patients with that diagnosis. Although these two conditions had high mortality rates, together they accounted for only 42 patients, therefore the resulting mortality as a percentage of the whole was smaller (29.4 per cent). More deaths were recorded in the non specific category of "acute but ill defined CVD" (436 and 436.1)

Cerebral thrombosis accounted for the greatest number of patients, 83 (24.1 per cent), in a definitive diagnostic category. The mortality rate in this study for patients with cerebral thrombosis was 23.5 per cent.

The average length of stay of those suffering from hemorrhage is compared with cerebral thrombosis in table 9. It can be seen that, in general, length of stay is longer for those with thrombosis than for those with hemorrhage.

The Sample Population

The reader will remember that it was necessary to choose a sample of patients from the study population for further investigation in order to retain confidentiality. The sample of 37 patients having

TABLE 9

AVERAGE LENGTH OF STAY BY SPECIFIC DIAGNOSIS AND DISCHARGE STATUS

Discharge Status	Subarachnoid Hemorrhage 430	430.1	Cerebral Hemorrhage 431	431.1	Cerebral Thrombosis 433	433.1
Alive	20.16	57.1	20	24.8	40.15	43.48
Dead	6.7	2.16	4.2	14.7	53.11	74.9

been determined, a "t" test showed no significant difference ($\alpha = .05$) in length of stay between the sample and the study population. This was considered important as hospitalization costs for all subsequent re-admissions would be calculated using the sample on the basis of length of stay. The sample consisted of five sub groups: (1) those who died during their initial admission to hospital; (2) those who had been discharged alive and not re-admitted; (3) those who had been re-admitted once during the twelve months following discharge after the initial insult; (4) those who had been re-admitted twice; and (5) those who had been re-admitted three times or more.

There was a larger percentage of males in the sample (73 per cent) and all patients were over 45 years of age, the majority (65 per cent) being 65 and over. The method used to stratify the sample pre-determined the number discharged alive, 28. Forty-three per cent of the patients were discharged from one hospital (Hospital Three). The length of stay ranged from one to 151 days, the average being 23.5 days, and the majority (75 per cent) stayed 25 days or less.

Of the 28 discharged alive, 24 returned home, two were referred for further rehabilitation, and two were discharged to a nursing home.

The sample was equally divided in regard to presence or absence of paralysis.

Diagnostically, codes 436 and 437 (ill defined disease) accounted for nineteen patients in the sample. Cerebral thrombosis was the diagnosis for ten patients and the majority of patients in this category had residual paralysis (table 10).

The sample stratified by number of admissions was representative of the study population in regard to length of stay which, for the cost purposes of this study, was considered the critical variable, since length of stay would be the basis for estimating hospitalization costs. However, in examining the sample further, it is questionable whether it could be considered representative of the study population in regard to the other variables which might have been factors in hospitalization and/or medical costs. The decision that the specific variable could, or could not, have influenced costs is a judgement decision made by the investigator. The likelihood of the sample's representativeness is illustrated in table 11.

Hospitalization Costs: Initial Admission

Hospitalization costs were calculated for the total study population for the first admission. It is recognized that

> . . .the actual costs of hospital care depend, amongst other things, on the disease being treated and the cost on any

TABLE 10

INITIAL DISCHARGE BY DIAGNOSTIC CATEGORY: SAMPLE GROUP

H-ICDA Code	Diagnosis	Total N	N without residual paralysis	N with residual paralysis
430	Subarachnoid Hemorrhage	2	1	1
431	Cerebral Hemorrhage	1	-	1
432	Occlusion of precerebral arteries	3	2	1
433	Cerebral Thrombosis	10	3	7
434	Cerebral Embolism	-	-	-
435	Transient Ischemic Attacks	2	2	-
436	Acute but ill defined CVD	8	4	4
437	Generalized Ischemic CVD	11	10	1
ALL CODES		37	22	15

TABLE 11

TABLE ILLUSTRATING REPRESENTATIVENESS OF SAMPLE TO STUDY POPULATION

	Variables which might have affected costs	Medical Costs	Hospital Costs	Was sample judged to be representative?
1	Length of Stay	Yes	Yes	Yes (shown by "t" test)
2	Discharge Status	Yes	Yes	Yes (by stratification of sample)
3	Age	No	Yes	No
4	Sex	No	No	No
5	Diagnostic Category	Yes	Yes	Yes
6	Marital Status	No	Yes	Yes
7	Paralytic State	Yes	Yes	No
8	Hospital	No	Yes	Yes
9	Discharge Placement	No	Yes	No

particular day depends upon the stage of the illness one is considering.[1]

It is also recognized that a more accurate figure of "cost per case" would take into consideration all aspects of health care delivered at that time.

Given the above, the costs presented in table 12 can only be deemed approximate. Each patient's length of stay was multiplied by the appropriate per diem rate according to year and hospital of admission. There are no specific data in the Alberta health care system specifying cost per case, or by diagnostic category. Whilst agreeing that the cost figure is an incomplete estimate, the investigator would underline that the procedure is at least consistent with that used by other authors and health care economists who use per diem rates to calculate hospitalization costs and decide hospital budgets on this basis.[2]

Table 12 shows the breakdown of hospitalization costs by hospital. The average cost per patient for hospitalization on the occasion of the initial insult was $1,985 with a range from $62 to $53,175. Considerable difference will be noted between the average costs in each hospital, Hospital Two having the highest average in this study, consistent with the fact that this hospital also had the highest

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[1]Personal communication from Dr. D.D. Gellman, M.D., F.R.C.P.(C), Acting Director General, Health Standards and Consultants, Health Programs Branch, Department of Health and Welfare, Ottawa, Canada (March 27, 1974).

[2]N.H. Bryant, et al., "Comparison of Care and Cost Outcomes for Stroke Patients With and Without Home Care," Stroke 5 (January-February 1974): 54-59.

TABLE 12

HOSPITALIZATION COSTS, BY HOSPITAL, OF FIRST ADMISSION FOR 344 PATIENTS DIAGNOSED AS PRIMARY STROKE: STUDY POPULATION

HOSPITAL AND NUMBER OF PATIENTS		HOSPITALIZATION COSTS							LENGTH OF STAY IN DAYS	
Hospital	N	Minimum $	Maximum $	Range $	Average $	Median $	Mode $	Total $	Average Length of Stay	Range of Length of Stay
1	80	62	7,242	7,179	1,204	812	62	96,328	20.0	1-116
2	56	63	53,175	53,112	3,227	1,141	570	180,688	49.5	1-792
3	139	65	35,949	35,884	2,081	759	65	289,269	34.4	1-521
4	69	70	11,128	11,057	1,693	1,122	499[a] 1,213	116,834	24.0	1-156
TOTAL STUDY	344	62	53,175	53,112	1,986	886	65	683,119	31.4	1-792

[a]Bi-model value

average length of stay. The difference is not so great if one examines the median cost. Hospital Two and Hospital Four show little difference, and similarly Hospitals One and Three. The average cost per patient with paralysis was $2,778 as compared with $1,569 for those without.

In table 13 the costs for the sample group are presented. Again, Hospital Two has the highest average cost, but in this case it also has the highest median cost.

Re-admissions

The Study Population

A listing of those patients from the total study population who had been re-admitted to institutions within a one-year period from their initial discharge was obtained from the AHSC. This information is presented in table 14. There was a total of 190 re-admissions amongst 124 patients. Of those discharged alive from the initial episode, 135 (52 per cent) were not re-admitted during the year following discharge, to any institution submitting information to the AHSC. The number of re-admissions per patient ranged from one to a maximum of six, 119 had two or more re-admissions.

Fifteen patients died during subsequent re-admissions, bringing the total number of known deaths to one hundred (29 per cent of the study population). There may have been other deaths occurring at home, but these could not be identified in this study.

Further problems of cerebrovascular disease (including strokes)

TABLE 13

HOSPITALIZATION COSTS, BY HOSPITAL, FOR FIRST ADMISSION OF 37 PATIENTS WITH DIAGNOSIS OF PRIMARY STROKE: SAMPLE

HOSPITAL AND NUMBER OF PATIENTS		HOSPITALIZATION COSTS							LENGTH OF STAY IN DAYS	
Hospital	N	Minimum $	Maximum $	Range $	Average $	Median $	Mode $	Total $	Average Length of Stay	Range of Length of Stay
1	7	250	7,242	6,992	2,067	1,068		14,467	34.0	1-116
2	6	570	9,567	8,997	2,658	1,396		15,951	41.5	9-151
3	16	65	5,106	5,041	1,033	563	324	16,536	15.0	1- 74
4	8	71	3,295	3,223	1,231	981		9,850	17.5	1- 47
All Hospitals	37	65	9,567	9,503	1,535	874	324	56,803	24	1-151

TABLE 14

READMISSIONS BY REASON, BY TYPE OF INSTITUTION, AND BY DISCHARGE STATUS, FOR 124 PATIENTS FROM STUDY POPULATION DURING ONE YEAR FOLLOWING INITIAL DISCHARGE

READMISSIONS	N	REASON FOR READMISSION		TYPE OF INSTITUTION			DISCHARGE STATUS	
		CVA	NON CVA	ACUTE	REHAB.	EXT. CARE	DEAD	ALIVE
1st	124	65	59	70	29	25	6	118
2nd	49	18	31	36	10	3	4	45
3rd	13	7	6	11	-	2	4	9
4th	2	1	1	1	1	-	-	2
5th	1	-	1	1	-	-	-	1
6th	1	-	1	1	-	-	1	1
		91	99	120	40	30	15	175
Total		190		190			190	

were responsible for 91 re-admissions (47.9 per cent). More than half (52 per cent) of the first re-admissions were as a result of re-occurring stroke.

It is known that of those discharged alive with some degree of residual paralysis, 56 (59.5 per cent) were re-admitted one or more times. In comparison, 68 (39.4 per cent) of those discharged without paralysis were re-admitted between one and six times (table 15). Of the 124 patients re-admitted, 45 per cent suffered from some residual paralysis at the time of their initial stroke.

The majority of patients continued to be re-admitted to acute hospitals, but not always the same hospital from which they had been discharged following their initial stroke. It is interesting to note that thirty patients (11.6 per cent) were re-admitted to "extended care" or "long term care" institutions - defined for the purposes of this study as auxiliary hospitals and/or nursing homes. There were forty subsequent re-admissions to a rehabilitative centre.

In table 16, the length of stay is indicated for subsequent re-admissions. A considerable proportion of those re-admitted once stayed over thirty days (forty per cent) compared with 17.7 per cent who stayed over thirty days on original admission. Of those re-admitted twice, 24 per cent stayed thirty days or more, and on the third admission 38.4 per cent.

Further examination of the 26 patients who had lengths of stay of over ninety days on first re-admission showed that eighteen had been admitted to extended care facilities and five to a rehabilitation facility.

TABLE 15

NUMBER OF RE-ADMISSIONS WITHIN ONE YEAR, BY PARALYTIC STATE: STUDY POPULATION

PARALYTIC STATE[a]	NUMBER OF READMISSIONS						TOTAL
	1	2	3	4	5	6	
P.	29	21	5	1	-	-	56[b]
N.P.	46	15	6	-	-	1	68[c]
Total N	75	36	11	1	-	1	124

[a] P. Those patients with residual paralysis from the initial incident.
N.P. Those patients without residual paralysis.

[b] 56 patients with residual paralysis accounted for ninety hospital readmissions.

[c] 68 patients without residual paralysis accounted for one hundred hospital readmissions.

The Sample Population

The reader will remember that the sample population was stratified on the basis of admissions. Table 17 illustrates the details of re-admissions for those patients in the sample. Twenty-one re-admissions were recorded for thirteen patients. There were no further deaths on re-admission and only nineteen per cent had a diagnosis of further CVA in comparison to the fifty per cent of the total survey group.

TABLE 16

LENGTH OF STAY[a], BY SUBSEQUENT READMISSION, OF 124 PATIENTS FROM TOTAL STUDY POPULATION

READMISSION	LENGTH OF STAY IN DAYS												TOTAL
	1	2	3	4-6	7-10	11-14	15-19	20-29	30-59	60-89	90-1 yr.	Over 1 yr.	
1st	1	2	1	16	18	17	5	14	19	5	19	7	124
2nd	3	4	1	8	5	4	4	8	5	1	6	-	49
3rd	1	-	-	2	2	1	1	1	2	1	1	1	13
4th	-	-	-	-	-	2	-	-	-	-	-	-	2
5th	-	-	-	-	1	-	-	-	-	-	-	-	1
6th	-	-	1	-	-	-	-	-	-	-	-	-	1
Totals	5	6	3	26	26	22	12	23	26	7	26	8	190

[a]Length of stay obtained from AHCIC in terms of their coding system.

TABLE 17

READMISSIONS OF SAMPLE POPULATION, BY REASON, TYPE OF INSTITUTION, AND DISCHARGE STATUS, ONE YEAR FOLLOWING DISCHARGE

READMISSIONS	N	REASON FOR READMISSION		TYPE OF INSTITUTION			DISCHARGE STATUS	
		CVA	NON CVA	ACUTE	REHAB	EXT. CARE	DEAD	ALIVE
1	13	3	10	9	3	1	-	13
2	5	1	4	4	1	-	-	5
3	2	-	2	2	-	-	-	2
4	1	-	1	1	-	-	-	1
		4	17	16	4	1	-	21
Total	21	21		21			21	

Hospitalization Costs

As indicated previously, the hospitalization costs for re-admissions were calculated only for the sample group. In table 18, the approximate costs are presented in three subtables. Subtable (i) deals with the first re-admission; subtable (ii) with the second re-admission; and subtable (iii) with the costs for those patients who had three or more re-admissions. Because of the low numbers in each group, it must be stressed that the figures should be regarded with extreme caution, as the ranges of cost might indicate. The same problems discussed in relation to the study population costs for the first admission are just as applicable here and are compounded by the fact that when costs are related to institutions such as nursing homes and auxiliary hospitals, they could only be estimated on daily rates. It was considered important, however, to establish some prototype model analyses and some base line figures which could be examined further at a later date in relation to their reliability and validity.

Medical Costs

Medical costs were calculated only for the sample, as previously noted. The following calculation represents an estimated cost for a patient from the sample, for the hospitalization costs for the initial admission and one further admission in the twelve-month period following discharge, together with medical costs for the period of the study. Attention is directed to a breakdown of medical (as distinct from hospitalization) costs for those in the sample (table 19).

TABLE 18

LENGTH OF STAY AND COST OF SUBSEQUENT HOSPITAL RE-ADMISSIONS FOR SAMPLE GROUP IN TWELVE MONTH PERIOD FOLLOWING INITIAL DISCHARGE[a]

(i) Cost of First Re-admission

		L.OF S. (DAYS)		HOSPITALIZATION COSTS						
Institution[a]	N	Average L.of S.	Range L.of S.	Minimum	Maximum	Range	Average[c] Cost	Median	Mode	Total Cost
3[b]	2	9	5-13	$ 399	$ 897	$ 497	$ 648	$ 648	-	$ 1,296
4[b]	4	17	13-22	911	1,878	967	1,263	1,131	-	5,052
5[b]	1		11							693
6	3	141	4-364	145	17,716	17,571	6,753	2,399	-	20,260
7	1		364							2,366
Totals	11	80	4-364	145	17,716	17,571	2,687	1,122		29,667

[a] Institutions: 3, 4, 5 } Acute general hospitals
6) Rehabilitation facility
7) Extended care, including auxiliary care

TABLE 18 (cont'd)

(ii) Cost of Second Re-admission

Institution	N	L.OF S. (DAYS) Average L.of S.	Range L.of S.	HOSPITALIZATION COSTS Minimum	Maximum	Range	Average Cost[b]	Median	Mode	Total Cost
3	3	12	3-12	$ 207	$1,518	$1,311	$ 851	$ 828	-	$2,553
4	1		12							841
5	1		264							52,800
Totals	5	96	12-264	207	52,800	52,593	11,239	841		56,194

(iii) Cost of Three or More Re-admissions

Institution	N	L.OF S. (DAYS) Average L.of S.	Range L.of S.	HOSPITALIZATION COSTS Minimum	Maximum	Range	Average Cost[b]	Median	Mode	Total Cost
3	2	14	12-16	$ 828	$1,275	$ 477	$1,052	$1,052	-	$2,103
4	1		6							428
Totals	3	11	6-16	428	1,275	847	834	828	-	2,531

[b]The averages are distorted in the above tables by the small number in each category and should, therefore, be viewed cautiously.

TABLE 19

MEDICAL COSTS FOR A SAMPLE OF 35[a] PATIENTS, FOR PERIOD OF INITIAL HOSPITALIZATION AND ONE YEAR FOLLOWING DISCHARGE

Group[b]	N	Minimum $	Maximum $	Range $	Mean $	Median $	Total $
I	7[a]	18	221	203	102	127	717
II	17	42	740	698	242	154	4,108
III[c]	6	52	349	297	240	239	1,436
IV	3	191	991	800	460	197	1,379
V	2	337	462	125	400	400	799
All Groups	35	18	991	973	241	191	8,439

[a]Medical costs were unavailable for two patients in Group I.

[b]Group I - Patients who died on first admission.
Group II - Patients discharged alive and not readmitted to hospital.
Group III - Patients who were readmitted to an institution once.
Group IV - Patients who were readmitted to an institution twice.
Group V - Patients who were readmitted to an institution three or more times.

[c]Two patients originally in Group III were found to belong to Group II.

Average initial hospitalization cost: $1,535 (table 13)

Average cost for one re-admission: $2,687 (table 18)

Average medical cost for period of study: $ 241 (table 19)

Discussion of Findings

In this section, the findings of the study will be discussed in relation to findings as reported in the literature. It must be emphasized that most of the available literature on this topic originates from countries other than Canada, thus a risk is taken in trying to compare results which are factors of health care systems, and socio-economic systems which may not mirror the Canadian scene. In the United States of America health care is, to a large extent, the financial responsibility of the individual, and thus the individual may be more reluctant to become involved in the personal expense of of hospitalization and health care, factors conceivably related to differing hospital mortality rates and shorter lengths of stay.

Brewis has stated that in England only a small proportion of patients with strokes are admitted to hospital, in fact, only 14.3 per cent of patients with CVA were admitted.[1] In Canada, as in Scandinavia, it is more likely that the acutely ill patient will be nursed in hospital, but the scene is changing as more home care programs become available to help care for the stabilized patient.

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[1] M. Brewis, et al., "Neurological Disease in an English City," Acta Neurologica Scandinavica 42 (Supplement 24, 1966): 46.

Length of Stay

The average length of stay for the total study population was 31.4 days, with an average of 30.9 for those who survived and 32.9 for those who died. Shafer quotes an average of 54 days for survivors and 22 days for those who died, in a population of new strokes.[1] Marquardsen, in a retrospective study, reported a range from one week to over a year, with the average length of stay 51.7 days for males and 72.7 days for females.[2] These stays were considerably longer than for comparable patients in the study presented here, males staying an average of 28.4 days and females 34.9 days.

There is a wide variation in reported average length of stay. Stern reports 59 days,[3] Carpenter 18,[4] Kahn 23.9 days,[5] and Wylie, quoting United States' statistics in 1965, reported an average of thirteen to 29 days depending on age.[6] P.A.S. hospitals in the United States in 1971 reported an average stay of 15.9 days for stroke

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[1]S. Shafer, et al., "The Outcome of Stroke at Hospital Discharge in New York City Blacks," Stroke 4 (September-October 1973): 784.

[2]J. Marquardsen, "The Natural History of Acute Cerebrovascular Disease," Acta Neurologica Scandinavica 45 (Supplement 38, 1969): 81

[3]P.G. Stern, et al., "Factors Influencing Stroke Rehabilitation," Stroke 2 (May-June 1971): 214.

[4]Carpenter, et al., p. 761.

[5]R. Kahn, "Stroke Rehabilitation in General Hospitals," Journal of American Hospital Association 45 (November 1971): 50.

[6]C.M. Wylie, "Hospital Care for Patients with Strokes in the Acute Stage," Journal of American Medical Association 193 (September 6, 1965): 137.

survivors, 75 per cent of patients staying 21 days or less.[1]

Canadian data are not readily available on this subject, except by provincial statistics. Information from Dr. P.C. Gordon gives the average length of stay of CVA patients in Nova Scotia, for the years 1971 and 1972, as 19.63 days and 18.8 days respectively.[2] For 250 Canadian hospitals participating in the PAS in 1971, the average for those surviving was 19.2 days.[3] In Ontario in 1972, the average length of stay for this category of patients in teaching hospitals was 19.9 days.[4] However, it is tenuous to compare the varying data on length of stay. Only the studies by Shafer[5] and Marquardsen[6] report on length of stay as related to new or first stroke. All authors agree, however, that length of stay is likely to increase with age, as it did in this study.

Age

Three age groups were considered in this study: 0-44 years; 45-64 years; and 65 years and over. The findings show a dramatic

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[1]Length of Stay in PAS Hospitals, United States, 1971. Commission on Professional and Hospital Activities, Ann Arbor, Michigan (October 1972) table 94, 49.

[2]Personal communication from Dr. P.C. Gordon, Professor and Department Head, Department of Preventive Medicine, Dalhousie University (March 1974).

[3]Length of Stay in P.A.S. Hospitals, Canada, 1971, table 94, 49.

[4]Relative Stay Index Report, 1972 Edition. Teaching Hospitals. Ministry of Health, Ontario (March 1972), detailed tables for diagnostic groupings, table 9, n.p.

[5]Shafer, p. 784.

[6]Marquardsen, p. 81.

increase in incidence with age and this is reported throughout the literature.[1,2,3,4] Eisenberg reported that only 23 per cent of the strokes in his study occurred in people under 65 years of age.[5] Steinberg reported similar figures.[6] In the present study, thirty per cent of the patients were under 65, and mortality was highest in the younger age group (0-44 years), and second highest in the 65 and over age group. This finding is supported by Marquardsen[7] and Prineas[8] in an Australian study.

Granger's findings that patients discharged to long term care facilities tend to be older,[9] agree with the findings of this study where 95 per cent of patients admitted to such facilities were over age 65.

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[1]Canada, Department of Health and Welfare, "Hospital Morbidity and Total Mortality in Canada," tables 11 and 12, pp. 36-43.

[2]Stallones, p. 363.

[3]Marquardsen, p. 19.

[4]E. Melamed, et al., "Stroke in Jerusalem District 1960 through 1967: An Epidemiological Study," Stroke 4 (May-June 1973): 470

[5]H. Eisenberg, et al., "Cerebrovascular Accidents: Incidence and Survival Rates in a Defined Population, Middlesex County, Connecticut," Journal of American Medical Association 189 (September 1964): 887.

[6]F.U. Steinberg, "The Stroke Registry: A Prospective Method of Studying Stroke," Archives of Physical Medicine 54 (January 1973): 33.

[7]Marquardsen, p. 41.

[8]R.J. Prineas, "Cerebrovascular Disease Occurrence in Australia," Medical Journal of Australia 2 (September 4, 1971): 511.

[9]C.V. Granger, et al., "Measurement of Outcome of Care for Stroke Patients," Stroke 6 (January-February 1975): 39.

Sex

In this study the patients were almost equally divided between the sexes, as was the incidence of paralysis. Stallones, in an extensive survey of literature, reports incidence rates higher for males than females;[1] however, other authors do not report any significant difference.[2,3] Marquardsen reports an excess of women beyond age sixty,[4] but this investigator found more males in the 65 and over age group.

Length of stay, longer for females, has already been discussed. More females were discharged to long term care institutions (56 per cent). Some authors suggest it is more difficult for women to return to their homes and communities if they are disabled and have to rely upon family and a willing and healthy spouse.[5,6] This factor could contribute to a longer stay in hospital for females.

Discharge Status

In the present study, 85 patients (24.7 per cent) died at the time of first admission to hospital and these were equally divided between males and females, with the highest mortality rate occurring in the under 45 age group.

Matsumoto reported a mortality rate of 38 per cent for first

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[1]Stallones, p. 366.

[2]F.J. Kurtzke, Epidemiology of Cerebrovascular Disease (Berlin: Springer-Verlag, 1969), p. 118.

[3]Eisenberg, p. 887

[4]Marquardsen, p. 19.

[5]Sky, p. 66.

[6]Marquardsen, p. 79.

stroke,[1] Boyle and Reid 35 per cent,[2] Shafer 41 per cent,[3] and Marquardsen 50.8 per cent on first admission.[4] The figures for this study would appear conservative viewed with other results. Of the 85 who died in this study, 36.5 per cent died within 48 hours, 48.2 per cent within six days. Ford reports eighteen per cent mortality in 48 hours and 41 per cent within one week,[5] and Dyken reports that 34 per cent of his study group died in hospital.[6] A further fifteen patients died in hospital on subsequent admission within the twelve-month period of this study. Thus it is believed that 71 per cent were alive one year following the initial insult. Kottke, summarizing other studies, believes thirty to sixty per cent of patients are still alive at one year, and 35 to forty per cent are alive eight years after their stroke.[7] Eisenberg reports only 28 per cent survived one year,[8] Brewis 59.9 per cent,[9] and Steinberg sixty per cent.[10]

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[1]N. Matsumoto, et al., "Natural History of Stroke in Rochester, Minnesota, 1955 through 1969 - An Extension of a Previous Study, 1945 through 1954," Stroke 4 (January-February 1973): 24.

[2]Boyle and Reid, p. 951.

[3]Shafer, p. 783.

[4]Marquardsen, p. 38.

[5]A.B. Ford and S. Katz, "Prognosis after Stroke, Part I - A Critical Review," Medicine (Baltimore) 45 (May, 1966): 229.

[6]M.L. Dyken, "Precipitating Factors, Prognosis and Demography of Cerebrovascular Diseases in an Indiana Community: A Review of all Patients Hospitalized from 1963-1965 with Neurological Examination of Survivors," Stroke 1 (July-August 1970): 263.

[7]Kottke, p. 11.

[8]Eisenberg, p. 885.

[9]Brewis, p. 51.

[10]Steinberg, p. 31.

It has already been mentioned that the present study did not grade the residual disability, nor the level of independence at discharge. It is known that, of those discharged alive, 36.2 per cent had some degree of residual paralysis. In a review of literature for health planning, Stallones, et al. made an estimation that for every 1,000 surviyors of stroke, ten per cent would be unimpaired, forty per cent would have mild residual disability, forty per cent would require special care, and ten per cent institutional care.[1] Steinberg reported 43 per cent of patients independent at time of discharge,[2] and Shafer 42 per cent.[3]

Discharge Placement

Marquardsen stated that the final disposition of patients was found to be influenced by age and sex, ultimate disability grade, domestic structure, and socio-economic stress.[4] While believing that some of the results of this study support that statement, it was not the intention of the investigator to enquire into the reasons behind discharge placements. Seventy per cent of the survivors in this study returned home, 76.7 per cent of those had no residual paralysis. A similar percentage went home as reported by Marquardsen[5] and Steinberg,[6] but only 49 per cent returned home as reported by Granger.[7]

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[1]Stallones, p. 369.

[2]Steinberg, p. 33.

[3]Shafer, p. 784.

[4]Marquardsen, p. 79.

[5]Ibid., p. 80.

[6]Steinberg, p. 33.

[7]Granger, p. 34.

Thirty-two patients of those with residual paralysis were referred to a rehabilitation facility in the present study, but all patients had been in acute hospitals where therapy services were available. In Steinberg's study, 25 per cent were transferred to a department of rehabilitation, but another 51 per cent received physiotherapy on a medical service.[1] Only five per cent of those in Shafer's study were referred for long term rehabilitation,[2] and only four of 427 survivors in a study reported by Carpenter required care both in a hospital and a rehabilitation facility.[3] The largest percentage from this study referred to the rehabilitation facility was from the 45-64 years age group.

The needs for rehabilitation services are variously recognized, and it is difficult to compare studies as the amount of rehabilitation received as a natural course of events during total patient care is not recorded. Wylie, however, identifies "slow referral patterns" from physicians to rehabilitative facilities,[4] and Kottke believes only a fraction of patients who could benefit are receiving such services.[5] Marquardsen stressed the goal of rehabilitation should be independence and self care in domestic resettlement, rather than vocationally oriented.[6]

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[1]Steinberg, p. 32.

[2]Shafer, p. 783.

[3]Carpenter, p. 761.

[4]C. Wylie, "Rehabilitative Care for Stroke Patients," Journal of American Medical Association 196 (June 1966): 1118.

[5]Kottke, p. 13.

[6]Marquardsen, p. 170.

In the year period of the study, there were thirty admissions to long term care institutions following discharge from the acute hospital. Marquardsen reported a similar finding, and also discusses the extraordinary length of stay spent by the relatively few incapacitated patients awaiting vacancies in other institutions,[1] a finding previously noted in this study.

Granger reports that eighteen per cent of his study group were discharged for long term care; they, also, tended to be older.[2] These findings are in agreement with those reported here.

Diagnostic Analysis

Considerable medical literature is available in regard to the various categories of stroke. A review indicates that investigators report incidences of 22 to 36 per cent for hemorrhagic stroke, with cerebral embolis and thrombosis being recorded most frequently and accounting for fifty to 65 per cent, and other types from ten to twenty per cent.[3] These are higher incidences than those recorded in this study where hemorrhage accounted for only 12.2 per cent of the diagnoses. Whisnant reports incidences more comparable from a similar study with hemorrhagic stroke accounting for fifteen per cent.[4] Matsumoto reported that sixteen per cent of patients had hemorrhage[5] and Melamed in Jerusalem reports twelve per cent with hemorrhage, 33

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[1] Ibid., p. 79.

[2] Granger, p. 34.

[3] Stallones, p. 34.

[4] Whisnant, p. 14.

[5] Matsumoto, p. 22.

per cent ischemias (thrombo-embolotic) and undetermined types 55 per cent.[1] These results compare very closely with this investigator's findings. In a Technical Report of the World Health Organization, it is reported that most investigators agree that the ischemic stroke is the most common single type and it is also agreed that the mortality rate is higher for the hemorrhagic type of stroke.[2]

In the present study the mortality rate on first admission was 59 per cent for hemorrhagic stroke. Adams, in a study carried out in Belfast in 1963-64, reported similar findings.[3]

Several authors, including Kurtzke,[4] warn about the measure of error in death statistics. Autopsy data are the only data which can be relied upon to give an accurate cause of death. Other researchers discuss the necessity for good and accurate clinical evaluation to enable a specific diagnosis to be made. Kuller states, ". . .presently there exists no simple objective measure to confirm the diagnosis of stroke analagous to the electrocardiogram used to measure absence or presence of myocardial infection."[5] The finding in this study of 43 per cent of the total study group in categories of generalized and ill

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[1]Melamed, p. 466.

[2]World Health Organization, Technical Report No. 469, pp. 12-13.

[3]G.F. Adams, "Prospects for Patients with Strokes, with Special Reference to the Hypertensive Hemiplegic," British Medical Journal 2 (July 1965): 254.

[4]Kurtzke, p. 114.

[5]L. Kuller, et al., "Nationwide Cerebrovascular Disease Morbidity Study," Stroke 1 (March-April 1970): 579.

defined diseases would seem to indicate the need for more accurate diagnosis.

Several authors have confined their studies to particular and specific categories, e.g., Dyken. In this way comparison between diagnostic groupings is probably more meanginful, but this does not allow a broad overview of the problem of stroke.

Costs

Hospitalization and medical costs in this study have been examined previously. Because of the poverty of information available, it is tenuous to compare data in this study with other appropriate reported costs.

Carpenter, using 1968 data, established an approximate annual cost of $2,100 for hospitalization of patients with cerebrovascular disease. This he recognized as only a partial cost, ignoring medication, laboratory tests, consultations, loss of productivity, etc. Furthermore, these costs were applied to all stroke patients and not to a population suffering first stroke.[1]

Kottke quotes estimated cost for care on a yearly basis for dependent, partially dependent, partially independent, and independent patients, as being $8,300, $6,000, $3,600 and $2,400 respectively (1972 United States dollars).[2] The probability as quoted by Kottke exists that 35 per cent of patients alive six months following their stroke

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[1]Carpenter, p. 762.

[2]Kottke, table I, p. 8.

will survive eight years or more.[1] Thus the need arises for programs which will help the dependent patient to become more independent and lessen the overall cost.

The average hospitalization cost for the initial admission in this study is $1,535 and for one re-admission $2,697. If one adds the medical costs incurred, the cost for a patient with one re-admission is approximately $4,472. The total recorded initial hospitalization cost is estimated to be $528,000 for 344 patients. This represents only ten per cent of all patients with a diagnosis of stroke discharged from acute hospitals in the Province of Alberta during a twelve-month period. It is possible, therefore, that the total annual cost for stroke patients, in acute hospitals in Alberta, could be as high as $5,000,000.

Speaking on costs in general, Wylie estimates that the charge for stroke patients tended to be 88 per cent of the average for all diagnoses in the United States; the patient day charges tend to decrease with rising age, but the overall charge rises sharply with age because of longer length of stay. He also comments on the small amount of total cost being spent on rehabilitation.[2] Drake points out that there are often associated complications with stroke resulting in inevitable cost increase.[3] Stern suggests that "properly supervised

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[1] Ibid., p. 11.

[2] Wylie, "Hospital Care for Patients with Stroke in the Acute Stage," p. 794.

[3] W.E. Drake, et al., "Acute Stroke: Management and Patient Outcome: The Value of Neurovascular Care Units (N.C.U.)," Stroke 4 (November-December 1973): 945.

auxiliary personnel" could cut the cost of elaborate and expensive rehabilitation methods without impairing quality of care.[1]

In 1973, the average length of stay for stroke patients in a rehabilitation facility in Edmonton was 76.5 days at a cost of $52.90 per day, a total average cost of $4,048 per patient.[2] The present study data indicate that there were forty admissions to this same facility during the study period. At an average cost of $4,048 per person, this represents an expenditure of $161,920 for the period of twelve months following discharge from the acute facility.

Medical costs have not been compared as they are not separately examined in the literature.

A study by Bryant compared cost outcome of stroke patients who received "home-care" and those who did not. The home-care patients had shorter hospital stays (average ten days less) and costs were greatly reduced. The cost was $3,450 for home-care patients versus $5,300 for the comparison group. Bryant's study includes all actual costs, excluding medical costs.[3]

A summary of the findings, together with conclusions and recommendations, is presented in chapter V.

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[1]Stern, p. 216.

[2]Data obtained from author's investigations cited in an unpublished paper, "Medical Rehabilitation - Some National and Local Aspects," p. 35.

[3]Bryant, p. 56.

CHAPTER V

SUMMARY OF MAJOR FINDINGS: CONCLUSIONS AND RECOMMENDATIONS

Introduction

As stated in chapter I, the primary objective of this study was to describe patterns of inter-institutional utilization of a specific population of Edmonton residents, those having sustained a first stroke. The purpose was to contribute to the collection of relevant baseline data which could be used to assist in the planning of health care and facilities for those persons suffering from chronic disease and/or disability, of which the study group represents a portion.

Attainment of the primary objective necessitated carrying out three specific sub-objectives: 1) description of the study population in relation to selected specific characteristics relative to patterns of care; 2) the following of the study population for a period of one year, in order to ascertain institutional utilization patterns during that period; and 3) estimating the associated hospitalization and medical costs for those patients. The major findings are briefly summarized below in terms of these objectives.

It was the investigator's initial intent to draw conclusions about patterns of inter-institutionalization in terms of all the independent variables, for example sex, age, etc. However, given the substantial variability between hospitals in such factors as length of stay, description of mean, median and modal patterns would have been not only meaningless but misleading Conclusions are stated in terms of central patterns of inter-institutionalization; recommendations are made.

Summary of Major Findings

Three hundred and forty-four residents of Edmonton were discharged from four acute general hospitals in Edmonton with a diagnosis of first stroke between July 1, 1971 and June 30, 1972. This incidence of .78 per 1,000 population is low compared to the literature.

Seventy per cent of the study population was over age 65; they accounted for 82 per cent of acute patient care days. The average length of stay overall was 31.4 days; 85 patients died on the first admission, 27 per cent of that number within 24 hours.

Cerebral thrombosis was the most frequent defined diagnosis; however, the greatest percentage of patients in this study had ill-defined diagnoses (41.2 per cent). The majority of those patients were discharged from one hospital (Hospital Three). Diagnostically, the highest mortality rate occurred in those patients with hemorrhage and forty per cent of the study group had residual paralysis at time of discharge. It was found that length of stay increased with age.

Of the 259 survivors, initially 181 (seventy per cent) were discharged home, 34 (thirteen per cent) were referred to a rehabilitation centre, and 23 (8.8 per cent) were discharged to long term care in auxiliary hospitals and nursing homes. Two patients were lost to the survey, and 19 (7.3 per cent) were discharged to relatives out of the Edmonton area. Subsequently, within a twelve-month period following initial discharge, 124 patients were re-admitted at least once for further institutional care, with a range of one to a maximum of six re-admissions, for a total of 190. The cause of first re-admission was cerebrovascular disease in fifty per cent of the cases. The re-

admissions were to all three types of institutional care (acute hospital, rehabilitation hospital and long-term care). The small percentage of patients ultimately referred to long term care accounted for the largest percentage of acute hospital days.

The characteristics of the study population tend to be consistent with those reported in the literature, with the exception of incidence which would appear to be low.

Hospital costs were grossly estimated for the total population and for a sample of 37. Medical costs pertaining to the period of study were examined for patients in the sample only. As an illustration, the total hospitalization and medical costs for a patient in this study, having one re-admission during the study period, was estimated on a gross basis to be $4,472. These are only partial cost data.

Conclusions

On the basis of the findings of this study, it is concluded that the following are the predominant inter-institutional patterns of utilization: almost half of the survivors of first stroke required further institutional care of some kind at least once during the twelve months following their initial discharge, and a large proportion (nineteen per cent of the survivors) were re-admitted more than once in that same period. The majority of these patients were over age 65.

The central conclusion in regard to patterns of inter-institutional utilization is that the acute facility (the acute general hospital) played the major role in providing institutional care for such patients for at least one year following the initial stroke.

Although the findings of the study allow the calculation of an overall incidence rate, and mortality rates are available, there seem to be no data available regarding prevalence rates. In order to plan health care services for specific groups, it is necessary to know both incidence and prevalence, prevalence being a joint function of incidence, rate of recovery and duration of survival. Therefore, one must assume that the planning of resources for those patients is presently based on partial estimates and other types of information.

The present study group had a survival rate of seventy per cent at the end of one year. This closely approaches Kottke's estimate.[1] Kottke also estimates rates for five-year and eight-year survival (forty per cent and thirty per cent respectively). Stallones estimates that 1250 institutional beds are required for these patients, per one million population, per year.[2] Using these figures it might appear that Edmonton would require approximately a "constant" total of 600 beds for dependent stroke patients per year.

The conclusions regarding costs must be regarded as highly tentative in nature. The problems of accurate data collection, as outlined previously, together with the questionable practice of using per diem costs, have limited the value of the resultant estimate. The cost as calculated does not include all other costs involved, e.g., home-maker, drugs, income subsidization, etc. With this in mind the investigator believes the costs quoted to be conservative, as they clearly represent only partial costs.

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[1] Kottke, p. 11.

[2] Stallones, p. 361.

Recommendations

The major recommendations of this study result from the investigator's experience during the period of data collection and analysis.

1. It is recommended that consideration be given to the construction of a comprehensive data bank containing information on patients with chronic disease, and using resources available from the Alberta Hospital Services Commission, the Alberta Health Care Insurance Commission, the Department of Social Services and Community Health, registries, hospital records, vital statistics, etc. Although data from each of these sources are available to a varying degree, they cannot be easily co-ordinated and utilized. A model such as that suggested by Gordon, with necessary modifications, might assist in the task of assembling, interpreting and analyzing data for record purposes.[1]

2. It is recommended that some consideration be given to the reduction of human error in data recording. The present identification system used by AHCIC does not permit an individual to receive and retain one unique number whilst registered with the commission. The number will change upon the subject reaching adulthood, and for a woman it will change with any change in marital status. This multiple identification system can cause confusion and unreliability of data. A single unique and continuous identification number would help to reduce error.

Further error is possible in the many steps involved in patient documentation: such factors as notations upon admission to hospital, incomplete physicians' notes, incorrect billing by physicians should

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[1] Gordon, pp. 197-199.

all be examined in light of the incidence of human error.

3. It is recommended that a comprehensive, province-wide, longitudinal study be undertaken in order to gather baseline data in regard to incidence, prevalence and mortality rates for chronic diseases such as stroke. The present study has been limited to a prescribed geographical area, Edmonton, and deals only with one portion of a category of persons who will need continuing care as a result of a chronic disease and/or disability. Present data do not allow accurate planning for the needs of such persons. The model used in this study could be applicable with the proviso that it would be necessary to conduct population surveys in order to obtain prevalence rates.

If a more comprehensive study were to be attempted, it is hoped that some of the problems encountered in this study could be avoided. Scope of such a survey could be increased by extending the study over a longer time period and by using a sample stratified by period following discharge from hospital, e.g., three months, six months, eighteen months, etc.

It is also suggested that the study could be expanded to include all patients with a primary diagnosis of stroke, not only those with first stroke as this would provide data on prevalence.

Although the investigator appreciates that to introduce interview techniques into such a study, a case can be made for invasion of individual privacy, it is believed that such a technique would be acceptable to citizens if they realised the value of the information obtained and if they could participate on a voluntary basis. The data thus obtained would allow more definite conclusions to be drawn.

4. It is recommended that detailed cost analyses be undertaken by diagnostic category. These would provide valuable information in regard to utilization of institutions, and could lead to cost-benefit analysis of specific rehabilitation centre services, compared to the cost of such services in a general hospital, or those provided in alternative ways. Presently acute care costs are unknown for stroke, and such information might be gained using a model such as that described by Babson.[1]

5. It is recommended that the reasons for the rather extreme variability in such factors as length of stay and diagnostic patterns between the four hospitals used in this study, be pursued.

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[1] Babson, pp. 1-63.

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APPENDIX A

CIRCULAR LETTER FROM DR. J. BRADLEY, CHAIRMAN, ALBERTA HOSPITAL SERVICES COMMISSION TO ACTIVE, AUXILLARY HOSPITALS AND NURSING HOMES IN EDMONTON

APPENDIX A

AHSC
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CIRCULAR LETTER

June 22, 1973

TO: ADMINISTRATORS

ALL ACTIVE, AUXILIARY HOSPITALS
AND NURSING HOMES IN EDMONTON

A study, endorsed by the Alberta Hospital Services Commission, on patterns of institutionalization of stroke patients is proposed for Edmonton acute and auxiliary hospitals and nursing homes.

It is proposed that a sample of Edmonton residents suffering their first stroke be studied, and in order to do so the investigator will need the cooperation of certain members of hospital staff, primarily Medical Records, and accessibility to discharge lists and patients' charts. Information about individual patients and physicians will be kept confidential and no names will be used in the report of the study.

Tentatively, a pilot study is planned for late June and July, with the main study being conducted during September to December 1973.

The investigator will be Doreen Moore, a second year student in the Master's of Health Services Administration program, University of Alberta. We would ask that when she contacts you that you give her your full cooperation as the findings from this study are likely to be of real benefit to the participating hospitals and to those planning health facilities. A summary of the complete findings will be provided each participating hospital.

Meanwhile, should you have any questions concerning the study, feel free to contact either Mr. L.L. Wilson, Commissioner for Hospitals at the Alberta Hospital Services Commission, or Miss Doreen Moore at 439-0580 (or contact her through the Division of Health Services Administration at 432-6407).

Yours sincerely,

J.E. Bradley, M.D.,
Chairman.

APPENDIX B

DETAILED ANALYSIS OF THE LITERATURE

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DETAILED ANALYSIS OF THE LITERATURE

Introduction

The investigator has attempted to search the literature relevant to this study and published since 1962. Prior to the 1960's most of the related literature concentrated on medical aspects alone. Since then there has been evidence of considerable interest in all aspects of CVD and CVA.

The literature tends to have a definite geographical distribution with the bulk being published in the United States of America. Other studies originate from Europe, with scattered articles from elsewhere around the world. Canada has produced very little literature in the area being studied.

Early literature emphasized various aspects of epidemiology, morbidity and mortality, discussing the various effects of related factors such as age, sex, geographical distribution, race, and environment. More recent literature tends to emphasize that stroke appears to be age related, with incidence, prevalence and mortality increasing with age, but the relationship of other factors have not been fully evaluated.

Other literature, written by medical investigators, is directed toward the disease process, identifying clinical categories and appropriate care. It is generally agreed that more patients suffer cerebral infarction than hemorrhage, but mortality rates at onset are higher for hemorrhage than any other category. Recently the importance of transient ischaemic attacks as indicators of pending stroke has been acknowledged.

Examination of the utilization of facilities by CVA patients is inadequately documented, although the utilization is thought to depend upon socio-economic and cultural considerations to some extent. In general, it would seem that most patients return home after their stroke, but a small proportion of older patients are referred to long-term care institutions, and these same patients are largely responsible for the utilization of a majority of acute patient care days. Authors report that comparatively few patients are referred for intensive rehabilitation.

Other modalities of care are reported to vary in the same manner. The rising cost of health care in institutions has precipitated the development of other alternatives, such as home-care. Programs of community education directed at prevention and management have been developed.

The costs of care, either in an institution or elsewhere in the community, are poorly documented and, at best, are only estimates. There is no literature available in regard to cost per case, or disease cost.

Specific aspects of the literature related to the focus of our study are discussed below under the following major headings: key definitions; epidemiology; patterns of care; costs; and associated issues.

Key Definitions

Cerebral vascular disease and cerebral vascular accidents have already been briefly defined in chapter I. Although the term CVD covers a wide range of clinical manifestations, only those diseases of the brain manifested as stroke (CVA) are discussed in this paper. For the purpose of the study it is important to note the term "stroke" is employed according to the rubrics of the International Classification of Diseases (1965 revision).[1] The clinical diagnoses are listed as follows:

430 subarachnoid hemorrhage
431 cerebral hemorrhage
432 occlusion of pre-cerebral artieries
433 cerebral thrombosis
434 cerebral embolis
435 transient cerebral ischemia
436 acute, but ill defined CVD
437 generalized ischemic cerebral vascular disease.

Whilst each of these classifications contains several sub-groupings, any further complexity would not contribute to the clarity of this study, therefore only these seven categories are utilized.

Subarachnoid hemorrhage occurs when blood leaks into the subarachnoid space, usually from a ruptured artery or vein. Many are caused by aneurysms. In the vast majority of individuals, subarachnoid hemorrhage strikes instantaneously, the primary symptom being an excruciating headache. It can cause almost instantaneous death.[2]

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[1] World Health Organization, International Classification of Diseases: Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death, Vol. I (Geneva, W.H.O. 1967) Codes 430-437 (see Appendix B).

[2] J. Toole and A. Patel, "Brain Hemorrhage," in Cerebrovascular Diseases, 2nd edition (New York: McGraw-Hill Book Company, 1974) pp. 280-281.

Cerebral hemorrhage represents about ten per cent of all strokes.[1] It is a hemorrhage originating from a vessel in the brain parenchyma. The term is used both for the pathological condition and for the resulting clinical disease. Spontaneous cerebral hemorrhage tends to occur between ages fifty and seventy-five and is slightly more frequent in men than in women. Usually the patients are hypertensive and the episode tends to occur during activity. The hemorrhage can occur in any part of the brain.[2]

Occlusion of the pre-cerebral arteries. The arteries which give rise to the cerebral arteries can themselves become occluded from a variety of causes, preventing the proper functioning of the cerebral circulation giving rise to various neurological symptoms.[3]

Cerebral thrombosis is the formation, development and presence of thrombus in a cerebral artery or vein and the resultant clinical disease.[4]

Cerebral embolism is the sudden blocking of a cerebral artery by a clot (or other material, e.g., fat, air, cholesterol, etc.) brought to the point of blockage by the blood stream.[5] The most frequent cause is a blood clot often subsequent to rheumatic valvular heart disease in younger patients. In older patients cholesterol plaques are seen most frequently.[6]

Transient ischemic attacks are characterized by a sudden onset of usually repeated episodes of sensory and/or motor impairment caused by temporary inadequacy of blood flow to a localized area of the brain, disappearing completely within 24 hours.[7] There can be a variety of causes, but there is often a relationship between the condition and arthrosclerosis.[8]

Acute but ill defined CVD is an imprecise clinical diagnosis used to describe any attack of CVD when the underlying pathological change in the brain is not determined.[9]

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[1]Ibid., pp. 332-340.

[2]World Health Organization, Cerebrovascular Diseases: Prevention, Treatment and Rehabilitation, Technical Report No. 469 (Geneva: World Health Organization, 1971): 54.

[3]Ibid.

[4]Ibid.

[5]Ibid.

[6]Toole and Patel, p. 216.

[7]W.H.O., p. 57.

[8]Toole and Patel, p. 188.

[9]W.H.O., p. 54.

Generalized ischemic CVD is a generalized reduction of various mental functions and/or gradual development of neurological signs and symptoms commonly associated with acute cerebral thrombosis.[1]

Epidemiology

Although in the past few years there has been a flood of epidemiological studies considering various aspects of incidence, prevalence, mortality and other aspects of cerebral vascular accidents, it was not until 1964 that the first organized review of strokes and epidemiological research in cerebrovascular disease took place.[2]

The recognition of cerebrovascular disease as a major problem with resulting stroke, has been well documented and gave rise in 1970 to the World Health Organization sponsoring an International Conference on "Cerebrovascular Diseases, Prevention, Treatment and Rehabilitation," with a subsequent report. There was no Canadian representation at the meeting. A Joint Committee for Stroke Facilities was enacted in 1969 under the aegis of the American Neurological Association and several reports have been released, including an epidemiological survey.[3]

In a recent article, White showed that diseases of the circulatory system, of which stroke is one, rank high in the number of people affected in the United States each year, but they also rank high in impairment or limitation of activity and mortality.[4]

Unfortunately, the majority of studies have applied different principles of measurement and different diagnostic criteria and, thus, it is difficult to compare results. Several investigators have endeavoured to survey the literature, one of the foremost being Kurtzke.[5] The group chaired by Stallones reviewed and evaluated data

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[1] Ibid., p. 55.

[2] F. McDowell, "Report of New Orleans Meeting Concerning Epidemiology of CVD," Stroke 2 (March-April 1971): 101.

[3] Report of the Joint Committee for Stroke Facilities, "Epidemiology for Stroke Facilities Planning," R. Stallones, chairman. Stroke 3 (May-June 1972): 360-371.

[4] K.L. White, "Life and Death and Medicine," Scientific American 229 (September 1973): 27.

[5] F. Kurtzke, Epidemiology of Cerebrovascular Disease (Berlin: Springer-Verlag 1969).

from several United States' studies on incidence, prevalence and mortality of stroke in the United States, for the purpose of presenting information for planning health facilities and manpower resources for management of patients with stroke.[1]

There seems to be agreement that incidence, prevalence and mortality of stroke, occurring most frequently in the age group over forty years, all increase with increasing age. There is much less unanimity of opinion in regard to the effect of other factors such as sex, racial origin, geographical distribution, etc.

Most studies have been retrospective and the major sources of epidemiological material are hospital series, mortality statistics and population surveys.

Incidence

Incidence can be defined as the "attack rate of a disease," the number of new cases developing within a certain population during a fixed period of time. Authors tend to refer to the incidence of CVD as this is the predecessor to and includes stroke.

Reported world incidence rates vary from a low of 1.94 per 1,000 for men and 1.6 per 1,000 for women for a population aged 45-69 in Denver, United States of America, to a high of 9.49 for men and 6.80 for women in the same age group in Akita, Japan.[2] Katsuki reported a crude average annual incidence of 127 per 100,000 in Japan in 1966 (1.27 per 1,000),[3] a much lower figure than that reported by the World Health Organization.

A national United States' study in 1965 reported an incidence range of 150 per 100,000 (1.5 per 1,000) females in Miami and South Carolina to 405 per 100,000 for males in North Carolina considering the age group 45-69.[4] A more recent survey of several United States' studies, published in 1972, reported an estimated annual incidence rate ranging from 0.25 per 1,000 population in the 35-44 age group to nine per 1,000

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[1] Joint Committee for Stroke Facilities, pp. 360-371.

[2] World Health Organization, table 2, p. 12.

[3] S. Katsuki and Y. Hirota, "Current concepts of the frequency of cerebral hemorrhage and cerebral infarction in Japan," in Cerebrovascular Disease, 5th Conference. Edited by C.H. Millikan and R.G. Siekert. (New York: Grune and Stratton, 1966), p. 99.

[4] L. Kuller, et al., "Nationwide Cerebrovascular Disease Morbidity Study," Stroke 1 (March-April 1970): 88-89.

in the 65-74 age group, and forty per 1,000 over the age of 85.[1]

A study by Brewis reported an annual incidence of three per 1,000 population in a city in England.[2] Fugl-Meyer in Sweden reported an age specific incidence of 3.2 per 1,000 for those up to 65 years of age,[3] and Melamed reports a rate of .9 per 1,000 in his study of stroke in Jerusalem.[4]

Wylie used Canadian data from British Columbia, Ontario and Saskatchewan.[5] Using data from the British Columbia Government Employees' Medical Service Plan 1961-1967, the overall rate reported by Wylie was 2.2 per 1,000, varying from 1.9 under age twenty to 37.4 over 74 years of age; in Ontario the overall rate was 2.1. In Saskatchewan the overall rate was 2.4 per 1,000 and although hospital data show an increase in discharge rates, Wylie believed this did not indicate a rise in incidence, but rather an increasing acceptability of older patients with CVD by hospitals for care.

There appear to be some geographic or regional and urban-rural differences but Stallones points out that it is difficult to evaluate them at this stage.[6] Gordon reported interesting regional variations in Canada, with the highest rate tending to occur in Eastern Canada and the lowest rate in the West.[7]

There has been considerable comment regarding race as a factor in the incidence of stroke, especially in the United States. Stallones'

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[1]R. Stallones, et al., "Epidemiology for Stroke Facilities Planning," Stroke 3 (May-June 1972): table 2, p. 363.

[2]M. Brewis, et al., "Neurological Disease in an English City," Acta Neurologica Scandinavica 42 (Supplement 24, 1966): p. 7.

[3]A. Fugl-Meyer, et al., "The Post-Stroke Hemiplegic Patient II Incidence, Mortality and Vocational Return in Goteborg, Sweden," Scandinavian Journal of Rehabilitation Medicine 7:2 (1975): 80.

[4]R. Melamed, et al., "Stroke in Jerusalem District 1960 through 1967: An Epidemiological Study," Stroke 4 (September-October 1973): 470

[5]C. Wylie, "The Community Medicine of Cerebrovascular Diseases," Stroke 1 (November-December 1970): tables 3 and 4, pp. 288-289.

[6]Stallones, p. 367.

[7]P.C. Gordon, "The Epidemiology of Cerebral Vascular Disease in Canada: An Analysis of Mortality Data," Canadian Medical Association Journal 95 (November 1966): 1005.

survey of studies suggested that rates are higher amongst blacks than whites.[1] Rates for the Negro population are variously reported but, in general, the rates are higher.[2] Kurtzke questions the validity of data showing higher rates associated with race, and agrees with several other authors that the particular difference in incidence might be better explained by factors such as predominantly Negro populations, and higher incidences of hypertension, and socio-economic differences within the groups studied.[3]

Some investigators have considered environmental factors: Olivares reported a peak of incidence in summer in Mexico[4] while both Alter and Gordon commented on spring peaks.[5,6]

Incidence rates for the various clinical subdivisions of stroke vary and are further confused by changes in reporting of diagnostic patterns over the years. More accurate diagnostic procedures have substantially changed incidence rates. Kurtzke and Kurland note a cultural phenomenon in Japan where cerebral hemorrhage has been supposed to be indicative of superior intellect, thus biasing statistics in its favour.[7]

Stallones and other authors point out that information concerning clinical subdivisions is not precise,[8] and that there was a tendency

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[1]Stallones, p. 367.

[2]A. Heyman, et al., "Cerebrovascular Disease in the Bi-racial Population of Evans County Georgia," Stroke 2 (November-December 1971): 512; B. Bruun, et al., "The Epidemiology of Stroke in Central Harlem," Stroke 4 (May-June 1973): 1408; M. Alter, et al., "Cerebrovascular Disease: Frequency and Population Selectivity in an Upper Mid-Western Community," Stroke 1 (November-December 1970): 458; and Wylie, p. 387.

[3]Kurtzke, p. 118.

[4]L. Olivares, et al., "Risk Factors in Stroke: A Clinical Study in Mexican Patients," Stroke 4 (September-October 1973): 779.

[5]Alter, p. 458. [6]Gordon, p. 1004.

[7]J. Kurtzke and L. Kurland, "Epidemiology of Cerebrovascular Disease," in Cerebrovascular Survey Report for Joint Council Subcommittee on Cerebrovascular Disease, National Institute of Neurological Diseases and Stroke and National Heart and Lung Institute, ed. R.G. Siekert (Rochester: Whiting Printers and Stationers, 1970): 165.

[8]Stallones, p. 363; A. Ford and S. Katz, "Prognosis after Stroke, Part 1: A Critical Review," Medicine (Baltimore 45 (1966): 223; and L. Kuller, et al., "Survey of Stroke Epidemiology Studies," Stroke 3 (September-October 1972): 583-584.

until recently to eliminate from general studies and surveys those patients suffering from transient ischemic attacks.

Recently more focus has been placed upon the ischemic category as its importance as a precursor to cerebral infarction is becoming increasingly recognized.[1] The information about these episodes is particularly important, as preventative treatment methods can be highly successful.

World figures reported in the World Health Organization Technical Report indicate that where the diagnosis has been defined, cerebral thrombosis is the most frequent cause of stroke, followed by hemorrhage.[2] Other investigators have confirmed these findings.[3]

The treatment of underlying conditions also changes the incidence rates. There has been an increase in literature reporting on the etiology of stroke, but as this aspect is beyond the parameters of this study, it is not reported upon here.

In 1966 Gordon reported a decline in Canada for all CVD, with substantial decrease in cerebral and subarachnoid hemorrhages, but an increase in thromb-embolic disease.[4]

The ratio of cerebral hemorrhage to cerebral infarction in the United States was reported as high as 80:1 in 1920 and had decreased to 2:1 in 1965. There seemed to be an age relationship with cerebral infarction occurring four to six times more frequently in ages 45-64 and twenty times more frequently over 75 than does cerebral hemorrhage.[5]

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[1]Heyman, p. 280.

[2]World Health Organization, p. 12.

[3]J.P. Whisnant, et al., "Natural History of Stroke in Rochester, Minnesota, 1945 through 1954," Stroke 2 (January-February 1971): 14; Stallones, p. 367; N. Matsumoto, et al., "Natural History of Stroke in Rochester, Minnesota, 1955 through 1969," Stroke 4 (January-February 1973): 21; Bruun, p. 407; Melamed, p. 466; and M. Dyken, "Precipitating Factors, Prognosis and Demography of Cerebrovascular Diseases in an Indiana Community: A Review of All Patients Hospitalized from 1963 - 1965 with Neurological Examination of Survivors," Stroke 1 (July-August 1970): 263.

[4]Gordon, p. 1005.

[5]Whisnant, p. 13.

Prevalence

Prevalence refers to the number of cases of a condition or a disease in a defined population at any one point in time. We are dependent upon population surveys for this information. Prevalence is a necessary dimension to consider because rational planning of community resources requires that we be able to estimate the number of persons handicapped by disease entities such as stroke in any given population at any given time.

In the United States the national health survey of 1959-1961 found 2.1 persons with some degree of paralysis due to stroke per 1,000 population.[1] This figure did not include 188,000 residents of nursing and personal care homes, a third of whom had some degree of paralysis. It was also found that the prevalence in households is higher amongst men than women, men being cared for in the home by women, but disabled women being more frequently admitted to institutions for their care.[2] Kurland believes there are between one and one-half and two million persons with stroke in the United States.[3] A study by Erikson in Illinois in 1963 showed a prevalence of 84 per 100,000 for Whites and 64 per 100,000 for Negroes,[4] thus differing from Heyman who reported a much higher prevalence rate in Negros than Caucasians and a higher rate for men than women.[5]

All authors reviewed agree that prevalence rates increase with age; in addition Whisnant believes there is a sex difference.[6]

In Vellore, India, the prevalence rate was reported as 56.9 per

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[1]United States Department of Health, Education and Welfare, United States National Health Survey, "Selected Impairments by Etiology and Activity Limitation, United States, July 1959 - June 1961," Series B, No. 35 (July 1962): 18.

[2]Wylie, "Community Medicine of Cerebrovascular Disease," p. 389.

[3]L. Kurland, et al., "Current Status of Epidemiology of Cerebrovascular Disease," in Stroke Rehabilitation: Basic Concepts and Research Trends, ed. W.S. Field and W.H. Spence (St. Louis, Miss: Warren Green, 1967), chapter I, p. 3.

[4]H.L. Erikson, "The Epidemiology and Treatment of Strokes in Lake County, Illinois," Illinois Medical Journal 128 (September 1965): p. 341.

[5]Heyman, p. 511.

[6]Whisnant, p. 15.

1,000[1] and the World Health Organization reports a prevalence rate in Japan of 7.9 per 1,000 amongst persons over forty years of age.[2] In 1972 the Joint Committee on Stroke Facilities (Epidemiology) estimated a prevalence rate of twenty per 1,000 at age 45-64 to 95 per 1,000 after age 75. In a population of one million, 12,500 strokes could be expected each year.[3] Prevalence rates for Canada are not readily available.

Mortality

By 1966 cerebrovascular disease appeared in the listings of the ten leading causes of death in 54 of 57 countries reporting to the World Health Organization; it ranked among the leading three causes of death in forty countries, and accounted for 11.3 per cent of total deaths in the 57 countries reporting. In the majority of countries where it ranked among the top three causes, the proportion of deaths below age 25 was low, but deaths increased rapidly with age. The highest rate of three per 1,000 per year was reported from Japan and Taiwan, the lowest, 0.9 from Scandinavia, the Netherlands and Switzerland.[4] In 1971 it was the third leading cause of death in Canada with a mortality rate of 74.5 per 100,000.[5]

Several authors, including Kurtzke, warn about the measure of error in death statistics; unless the data are obtained by autopsy it is open to question.[6] Wylie suggests that the Eighth Revision of the International Statistical Classification of Diseases would bring about a change in reporting because of the increased specificity of diagnosis.[7]

In 1970, Wylie calculated that the probability of dying from CVA was 1:3.[8] Because stroke affects the older age group more frequently, its elimination as a cause of death during 1959-61 would, in theory, have extended life in the United States by only 1.3 years. Wylie also reports

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[1] J. Abraham, et al., "Stroke in the Young," Stroke 2 (May-June 1971): 264.

[2] World Health Organization, p. 11. [3] Stallones, p. 369.

[4] World Health Organization, p. 7.

[5] Alberta, Department of Health and Social Development, "Leading Causes of Death," in Quarterly Statistical Review (October-December 1973), table 1, p. 13.

[6] Kurtzke, "Epidemiology of Cerebrovascular Disease," p. 114.

[7] C. Wylie, "Death Statistics for Cerebrovascular Disease: A Review of Recent Findings," Stroke 1 (May-June 1970): 184-185.

[8] Ibid., p. 190.

lower death rates in the married population, among whites as compared to non-whites, although advising caution in regard to racial findings.[1]

In the United States the mortality pattern seems to follow the geographic pattern of hypertension - highest in the South Eastern states; within Canada the eastern provinces have the highest death rates, but generally rates are lower in Canada than in the United States.[2] Kurtzke and Kurland record that high death rates occur in states with fewer physicians per unit of population.[3]

Authors report varying mortality patterns and mortality rates for diagnostic groupings. Whisnant found that about 25 per cent of the group studied died within one month of the acute stroke.[4] Fugl-Meyer reports a high initial mortality rate,[5] as do other authors.[6] The probability of surviving thirty days after the onset of the first stroke is lowest for those patients with intercerebral hemorrhage and subarachnoid hemorrhage.[7] Wylie reported that 38 per cent of patients with hemorrhage died within one week.[8] Adams, in his Belfast study, found 55.7 per cent of patients with cerebral hemorrhage died compared to 34.3 per cent with cerebral embolis and 21.5 with cerebral thrombosis.[9] Kannel draws attention to the fact that several authors have documented an overall decrease in cerebrovascular mortality in the

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[1]Ibid., p. 189.

[2]Gordon, p. 1005.

[3]Kurland and Kurtzke, "Epidemiology of Cerebrovascular Disease," p. 167.

[4]Whisnant, p. 15.

[5]Fugl-Meyer, p. 77.

[6]S. Pitner, and C. Mance, "An Evaluation of Stroke Intensive Care: Results in a Municipal Hospital," Stroke 4 (September-October 1973): 738; W. Drake, et al., "Acute Stroke: Management and Patient Outcome: The Value of Neurovascular Care Units (N.C.U.)," Stroke 4 (November-December 1973): 944; H. Eisenberg, et al., "Cerebrovascular Accidents, Incidence and Survival Rates in a Defined Population, Middlesex County, Connecticut," Journal of American Medical Association 189 (September 21, 1964): 886.

[7]Whisnant, p. 17; and World Health Organization, p. 13.

[8]C. Wylie, "Rehabilitation Care for Stroke Patients," Journal of American Medical Association 196 (June 1966): 1117.

[9]G. Adams, "Prospects for Patients with Strokes with Special Reference to the Hypertensive Hemiplegic," British Medical Journal 2 (July 1965): 254-256.

United States, Canada, and Japan.[1] He also agrees with Kurtzke and Kurland that the marked excess of cerebrovascular mortality among non-whites may be exaggerated as a result of various socio-economic factors.[2]

Kurtzke and Kurland summarized international data on morbidity. Japan demonstrated high rates, especially in cerebral hemorrhage. Other countries had ranges from 97 to 118 per 100,000. As diagnostic techniques become more sophisticated there tends to be a demonstrated decrease in incidence and mortality rates for cerebral hemorrhage with a corresponding increase in the rate of infarction.[3]

Prognosis

Kurtzke evaluates the course of CVD in terms of survival patterns, and in considering all CVD from several reports, it seems that approximately twenty per cent died within six months, and sixty per cent by the end of five years.[4] Hospital series indicate 33 per cent died within two months and fifty per cent in two years. The survival rate and the prognosis vary considerably, depending upon the type of stroke, the severity and the age of the patient.

The World Health Organization report discusses work being done in studying transient cerebral ischemia, as a precursor to stroke.[5] From two to fifteen per cent of patients with ischemia develop stroke within a four-year period. Patients with untreated subarachnoid hemorrhage have the poorest prognosis, 75 per cent dying within five years. Eighty per cent of reoccurrences of subarachnoid hemorrhage are within six weeks and these are accompanied by a high mortality rate.

Boyle and Reid found that 35 per cent of their patients died on first admission and a further 61 per cent of survivors died by the eighth year.[6] Kannel suggests that about 25 per cent only will die of

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[1] W. Kannel, "Current Status of the Epidemiology of Brain Infarction Associated with Occlusive Arterial Disease," Stroke 2 (July-August 1971): 300.

[2] Kurland and Kurtzke, "Epidemiology of Cerebrovascular Disease," pp. 165-167.

[3] Ibid., p. 167.

[4] Kurtzke, "Epidemiology of Cerebrovascular Disease," p. 122.

[5] World Health Organization, pp. 13-15.

[6] R. Boyle and M. Reid, "What Happens to the Stroke Victim," Geriatrics 20 (November 1965): 951-952.

recurrent stroke while the majority will die of cardiovascular disease.[1] Whisnant, in the Rochester study, agrees, but the World Health Organization report suggests that the commonest cause of death is subsequent and recurrent CVA.[2]

Comparing seven studies regarding level of functional activity, Kottke reported that 57 to 81 per cent of patients fall into categories of varying independence.[3] He believes that as many as 35 per cent of patients after a major stroke will achieve a return to normal or nearly normal status. It is estimated that three to five per cent of patients remain totally dependent.[4]

Deterioration is not an inevitable result of stroke, but occurs because of additional complications.[5] The same studies allowed, Kottke further comments on survival - thirty to sixty per cent are alive at one year, fifteen to forty per cent at five years, twenty to thirty per cent at eight years. Of patients who survived six months following stroke, 74 to 95 per cent are alive one year following the episode.[6]

Eisenberg believes there is little difference in survival rates between those having their first stroke and those with subsequent stroke.[7]

In a fifteen-year follow-up of patients with transient ischemia, Goldner found that the probability of surviving fifteen years was less for patients under 65 years of age at time of onset.[8] Whisnant reported that 73 per cent of patients with cerebral thrombosis were alive after thirty days.[9] Those with cerebral hemorrhage had a one-month survivorship of 35 per cent.[9]

The ability to predict rehabilitation potential has thus far defied quantitative analysis[10] There are many aspects to consider

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[1]World Health Organization, p. 16.

[2]F. Kottke, "Historia Observa Hemiplegiae," Archives of Physical Medicine and Rehabilitation 55 (January 1974): 8-9.

[3]Ibid.

[4]Ibid., p. 10.

[5]Ibid., p. 11.

[6]Eisenberg, p. 888.

[7]J. Goldner, "Long Term Prognosis of Transient Cerebral Ischaemic Attacks," Stroke 2 (March-April 1971): 164.

[8]Whisnant, p. 15.

[9]Ibid., p. 16.

[10]J. Garston, "Evaluation of Rehabilitation Potential in Stroke Patients," in Stroke Rehabilitation; Basic Concepts and Research Trends, W.S. Fields and W.H. Spence, eds. (St. Louis: Warren H. Green, Inc., 1967), chapter V, p. 68.

besides actual paralysis, including amount of sensory defect, visual field defects, cognitive abilities, etc. Stern indicates that the rehabilitative prognosis will depend to a large extent upon the time span between onset of stroke and initiation of treatment, with the greatest benefit being derived by those who receive early treatment.[1] The greatest change is apparent in the self-care function.

Of the survivors of stroke, Stallones predicts that ten per cent will be independent and ten per cent will be completely dependent - the other eighty per cent will have varying degrees of independence.[2] Fugl-Meyer reported that 41 per cent of the patients in his study under the age of 65 could return to some occupation post stroke.[3]

Adams sums up the prognosis of stroke patients by noting that survival is greatly foreshortened; a recovered hemiplegic may have a relatively active life for about six years if under 65 years of age at onset, or three to four years if over that age, as compared to normal expectancy of fifteen years under 65 and nine years for those 65-75.[4]

Patterns of Care

Although stroke is an historical disease, recorded through early history, it was not until the 1950's that the various causes and possible treatment of strokes was becoming appreciated. Reinmuth remarked that receiving physicians in large city hospitals were, on the whole, disinterested in stroke; the numbers seemed unending, they were a group of patients for whom "nothing could be done and they filled beds preventing admission of more interesting patients."[5] Happily attitudes of the health care community are rapidly changing.

Wylie, in the 1960's, recorded the belief that many general hospitals discouraged the admission of stroke patients in the United States. He particularly felt that more effective acute care would mean the survival of more disabled patients.[6] He also commented that a

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[1] P.H. Stern, et al., "Factors Influencing Stroke Rehabilitation," Stroke 2 (May-June 1971): 217.

[2] Stallones, p. 369.

[3] Fugl-Meyer, p. 79.

[4] Adams, p. 256.

[5] O.M. Reinmuth, "Prologue to Guidelines for Stroke Care," Stroke 5 (January-February 1974): 110.

[6] Wylie, "Community Medicine of Cerebrovascular Disease," p. 391.

generous supply of acute beds in Saskatchewan in 1967, together with a paucity of long-term care beds at that time probably helped more people with CVD enter acute hospitals.[1]

Institutional utilization varies. Pitner maintains the majority of seriously ill patients in the United States have to be admitted.[2] Shapiro, as chairman of a Community Health Services study group, advocates that the patient be hospitalized for acute stroke care, but recognizes several other alternate facilities which may be required such as rehabilitation centres, chronic care institutions, etc.[3] Truscott found that the majority of patients with stroke experienced their primary care in a community hospital of less than 200 beds, for the most part rural hospitals, resulting in inequality of care, delayed diagnosis, inadequate treatment, and prolonged hospitalization.[4]

According to Brewis, only a small proportion of patients with stroke in Carlisle in the United Kingdom were admitted to hospital, 14.3 per cent.[5] In Finland patients suspected of CVD are treated in hospital.[6]

Recent years have brought the development of sophisticated care models consisting of Stroke Clinics, Stroke Units, Community Stroke Programs, Home Care, etc. One such a model has been set up in Harlem.[7] Richter and his team have found the intensive care stroke unit to function effectively, and so have Drake[8] and Dow.[9] However,

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[1] Ibid., p. 389.

[2] Pitner, p. 739.

[3] M.I. Shapiro, et al., "Community Health Services for Stroke," Stroke 5 (January-February 1974): 127.

[4] B.L. Truscott, "Changing Patterns of Stroke Care in the Community Hospital," in Stroke Diagnosis and Management: Current Procedures and Equipment, W.S. Fields and J. Moosey, eds. (St. Louis: Warren H. Green, Inc. 1973): chapter IX, p. 120.

[5] Brewis, p. 46.

[6] K. Aho, et al., "Incidence and Early Prognosis of Stroke in Espoo-Kauniainen Area Finland in 1972," Stroke 5 (September-October 1974): 660.

[7] R. Richter, et al., "Example of a Community Model for Comprehensive Stroke Services." The Harlem Regional Stroke Program in Community Health Services for Stroke, Stroke 5 (January-February 1974): 135.

[8] Drake, p. 944.

[9] R.S Dow, et al., "Failures and Successes in a Stroke Program," Stroke 5 (January-February 1974): 42.

Pitner[1] and Waylonis[2] question the value of such specialized units, believing effective care can be given to any patient in a generalized intensive care unit.

The "Stroke Centre" or specialized unit can have an advantage in providing specialized facilities for diagnosis and management including rehabilitation. Dyken suggests that effective care in such a unit can decrease the mortality of patients with cerebral infarction by as much as five and one half times.[3] The Stroke Clinic of which Dow writes was terminated because of poor utilization;[4] in contrast Richter believes the Stroke Clinic to be most important and effective in assisting patients, especially after discharge.[5]

Many study designs now consider discharge placements and the many possible routes available to a patient. Logically, the placement should depend upon the patient's condition (figure 2).[6] Shafer observed that to plan facilities for a population at risk it was necessary to know the extent of physical and intellectual damage in patients with new stroke, and the observed need for hospitalization.[7] Most investigators report that the majority of patients return home after the acute episode: Shafer, 42 per cent;[8] Marquardsen, 74 per cent with ninety per cent capable of being at home;[9] Granger, 49 per cent[10] and Bruun 53 per cent.[11]

Shafer reports that five per cent of his study population went to a long term rehabilitation hospital;[12] that proportion may be low

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[1]Pitner, p. 739.

[2]G. Waylonis, et al., "Stroke Rehabilitation in a Mid Western County," Archives of Physical Medicine and Rehabilitation 54 (March 1973): 153.

[3]Dyken, p. 152.

[4]Dow, p. 40.

[5]Richter, p. 138.

[6]Shapiro, p. 126.

[7]Shafer, p. 782.

[8]Ibid.

[9]J. Marquardsen, "The Natural History of Acute Cerebrovascular Disease," Acta Neurologica Scaninavica 45 (Supplement 24, 1966), p. 79.

[10]C.V. Granger, et al., "Measurement of Outcome of Care for Stroke Patients," Stroke 6 (January-February 1975): 34.

[11]Bruun, p. 407.

[12]Shafer, p. 783.

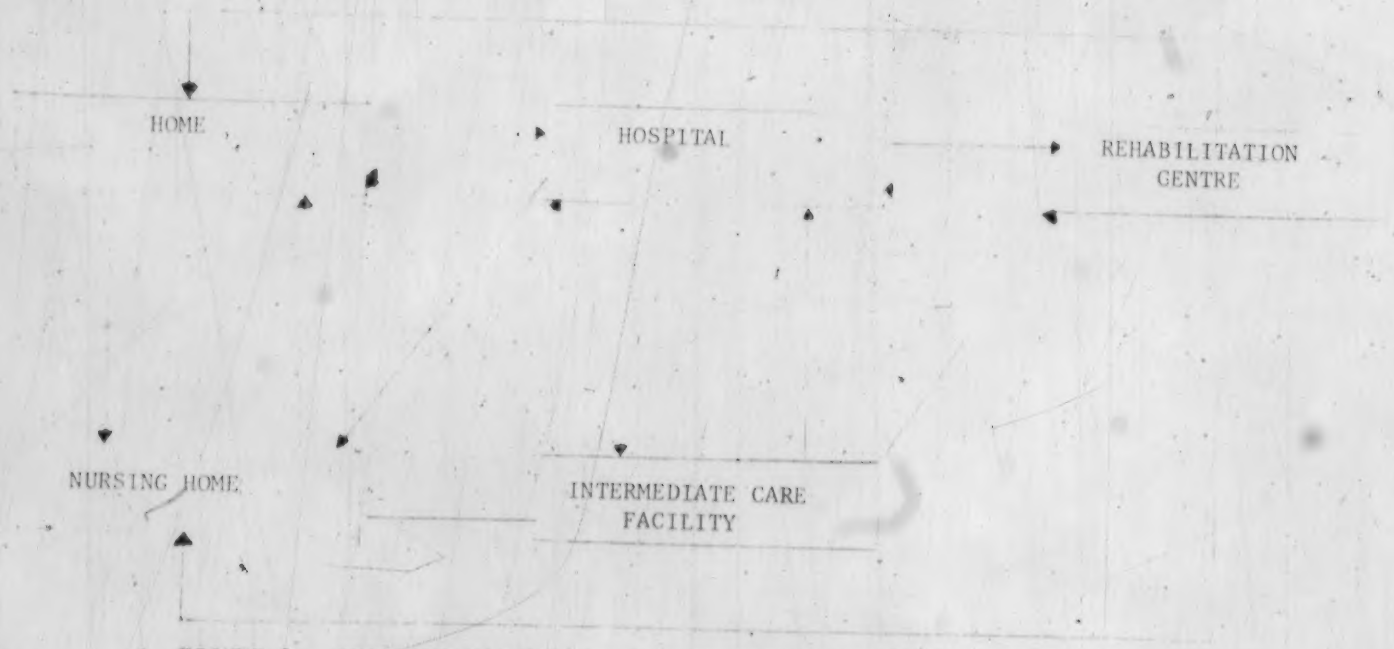

FIGURE 2: POSSIBLE INSTITUTION UTILIZATION ROUTES[a,b]

[a]Source: M.I. Shapiro, et al., "Community Health Services for Stroke," Stroke 5 (January-February 1974): 126.

[b]Chart showing some of the many possible routes facing the stroke patient. In most instances the route is a two-way street, as his condition improves or worsens. In all cases, medical surveillance and community services are required.

considering the percentage of patients who might benefit from further intensive rehabilitation. Matsumoto was of the opinion that 54 per cent of the Rochester patients had a neurological defect and that they might have benefited from further rehabilitation.[1] Granger reports twenty per cent referred to a rehabilitation unit, but of those thirteen per cent went back to an acute hospital and 37 per cent to long term care, a finding which illustrates the type of inter-institutionalization most likely to be observed in such groups.[2]

Reports of referrals to long term care institutions vary between seven per cent,[3] eleven per cent,[4] sixteen per cent,[5] and eighteen per cent.[6] All authors agree that patients from the older age group are the ones most frequently referred to long term care institutions.

The institution of various supportive programs within the community has meant that a larger percentage of patients can go home, and do so in less time. Home care programs such as the one described by Bryant are generally well accepted in their various forms.[7] Cummings describes the work done by a mobile rehabilitation unit which takes the clinic and its team to the patients, rather than vice-versa.[8]

The trend toward increased emphasis on every aspect of care involving the patient, the family and the community, together with the treatment team, has acted as an educational process for more effective management of stroke. The Joint Committee for Stroke Facilities has now published twelve reports designed to increase the effectiveness of care.

Costs

The available literature provides only estimates of cost of care

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[1] Matsumoto, p. 17.

[2] Granger, p. 34.

[3] Bruun, p. 407.

[4] Shafer, p. 783.

[5] Marquardsen, p. 79.

[6] Granger, p. 34.

[7] N. Bryant, et al., "Comparison of Care and Cost Outcomes for Stroke Patients with and without Home Care," Stroke 5 (January-February 1974): 54-59.

[8] V. Cummings, and B. Kutner, "The Rehabmobile: A Mobile Rehabilitation Clinic in an Urban Ghetto Area," Archives of Physical Medicine and Rehabilitation 54 (January 1973): 19.

for stroke patients. In the 1960's. Wylie[1] and Carpenter[2] estimated costs based upon per diem rates; and Kottke estimated costs of care based on level of independence, ranging from $2,400 per year in a retirement home for an independent patient to $8,300 for a completely dependent patient in a nursing home (United States 1972 dollars).[3]

Bell, quoting a study carried out in a stroke unit, stated that the cost is much higher than for a standard medical-surgical unit, an incomplete cost of $90 per day (1970).[4]

Although it is generally thought that the major cost occurs in the acute general hospital, Wylie suggests that there may be little cost difference between the efficient general hospital and the high quality institution for chronic illness.[5]

Bryant discusses the difference in cost outcomes for those patients referred to home care programs compared with those who are not. There is a substantial saving in days of acute care required and cost, the cost per day in an acute hospital being $144 compared with $8.70 per day for home care. The difference in total cost for the study amounted to approximately $5,000 per patient.[6] Other community methods include mobile rehabilitation units, but the cost is high - approximately $67 per visit.[7]

Medical costs are not discussed in the literature and, until recently, there has been little documented about cost per case and cost by diagnosis. Babson, in his book, illustrates a methodology which might be used for that purpose.[8]

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[1]C. Wylie, "Hospital Care for Patients with Strokes in the Acute Stage," Journal of American Hospital Association 45 (November 1, 1971): 794.

[2]Carpenter, p. 762. [3]Kottke, p. 8.

[4]R. Bell, "Cost-feasibility and Cost Benefit," in Stroke Diagnosis and Management, Current Procedures and Equipment, W.S. Fields and J. Moosey, eds. (St. Louis: Warren H. Green, Inc. 1973), chapter 10, p. 129.

[5]Wylie, "Rehabilitative Care for Stroke Patients," p, 1119.

[6]Bryant, pp. 58-49. [7]Cummings, p. 23.

[8]J. Babson, Studies in Social Administration: Disease Costing (Manchester: University Press 1973).

Although Babson illustrates costs for acute care, the model demonstrated takes into account all hospital costs and is not related to an overall per diem cost. This allows for individual differences according to the intensiveness of the care required, and includes associated direct and indirect cost.

Associated Issues

Data Collection

As previously mentioned, almost all the studies reported have depended on retrieval of data from hospital records, health surveys, etc. It is recognized that there are various agencies which have a great deal of information but such data are neither co-ordinated nor effectively utilized. Gordon, in 1973, presented a model which would assemble, integrate, summarize and analyze data received from relevant sources within the health information system.[1]

Interest in registries is being encouraged, especially since the use of computers, which can store and release relevant information in usable forms. Stern reports experience using a computerized system of data processing for a stroke unit.[2]

Other systems, such as PAS, have the potential for collecting and analyzing vast amounts of diagnostic data on patients who have been hospitalized, and PAS are prepared to present such data on request, and in special interest bulletins. However, such data are not generally so inclusive as to pertain to substantial populations in the wide scale epidemiological sense, and/or over long periods of time in terms of patient follow-up.

Length of Stay

Several author's have recorded length of stay in acute hospitals for those patients in their study, and this is an important aspect of the present study.[3] These findings are discussed in detail in relation to this investigator's findings in chapter IV.

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[1] P.C. Gordon, et al., "A Model for the Routine Evaluation of a Hospital Program," The Nova Scotia Medical Bulletin (October 1973): 197-198.

[2] P. Stern, et al., "Data Base for Stroke Rehabilitation Using Computerized English Text Discharge Summaries," Stroke 6 (March-April 1975): 181-187.

[3] Shafer, p. 784; Marquardsen, p. 81; Stern, p. 216; and others.

These then were the major characteristics of the literature reviewed, and it is upon this documentation that the summary analysis presented in chapter II rests.

APPENDIX C

ICDA CODES 430-437 CEREBROVASCULAR DISEASE

APPENDIX C

ICDA CODES

Cerebrovascular Disease

Excludes: hemorrhage due to:
birth injury
other trauma

430 Subarachnoid hemorrhage

meningeal hemorrhage
ruptured (congenital)(berry)
cerebral aneurysm

430.0 Without paralysis

430.1 With paralysis

431 Cerebral hemorrhage

hemorrhage (of):
basilar
brain stem
bulbar
capsular
cerebellar
cortical
extradural, non-traumatic
internal capsule
intracerebral
intracrainal NOS(1)

hemorrhage (of):
intrapotine
pontine
putamen
subcortical
subdural
thalmic
ventricular
rupture of blood vessel in brain
subdural hematoma, non-traumatic

(1) Not Otherwise Specified (NOS).

Source: International Classification of Diseases: Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death, Vol. I (Geneva: World Health Organization) 1967.

432 Occlusion of precerebral arteries

embolism
infarction:
  brain stem
  mdeullary
  midbrain
  pontine

occlusion or stenosis
  (of)(artery):
  basilar
  carotid (common)
    (internal)
  vertebral

432.0 Without paralysis

432.1 With paralysis

433 Cerebral thrombosis

cerebral artery occlusion NOS
cerebral infarct NOS
thrombosis, thrombotic:
  apoplexy
  brain

thrombosis, thrombotic:
  cerebellar
  encephalomalacia
    (softening)
  intracrainal

433.0 Without paralysis

433.1 With paralysis

434 Cerebral embolism

embolism, embolic:
  apoplexy
  brain

embolism, embolic:
  intracrainal
  encephalalomalacia
    (softening)

434.0 Without paralysis

434.1 With paralysis

435 Transient cerebral ischemia

basilar artery syndrome
intermittent cerebral ischemia
spasm of cerebral arteries
transient ischemic attack (TIA)
vertebral artery syndrome

435.0 Without paralysis

435.1 With paralysis

436 Acute, but ill-defined, cerebrovascular disease

apoplectiform convulsions
apoplexy, apoplectic:
NOS
bulbar
cerebral
fit

apoplexy, apoplectic:
seizure
stroke
cerebral seizure
cerebrovascular
accident (CVA)NOS
stroke

436.0 Without paralysis

436.1 With paralysis

437 Generalized ischemic cerebrovascular disease

atheroma of cerebral arteries

cerebral:
arteriosclerosis
endarteritis
ischemia NOS
thrombo-angiitis obliterans

cerebrovascular:
degeneration
insufficiency
sclerosis

Excludes: that with chronic psychotic brain syndrome (299.0)